ENGINEERS NORTHWEST, INC. P.S.

9725 THIRD AVENUE N.E., SUITE #207
SEATTLE, WASHINGTON 98115

PHONE - (206) 525-7560 / FAX - (206) 522-6698

LETTER OF TRANSMITTAL

TO: MG2 Architecture
1101 Second Ave, Ste 100
Seattle, WA 98101

DATE: February 25, 2021	JOB NO: 16038004
ATTENTION: Travis Morton	
RE: Costco Headquarters- Building 5	

WE ARE SENDING YOU ☒ Attached ☐ Under separate cover via COURIER the following items:

☒ Shop drawings ☐ Prints ☐ Plans ☐ Samples ☐ Specifications

☐ Copy of letter ☐ Change order ☐ _____

COPIES	DATE	NO.	DESCRIPTION
E	02/23/21		Submittal No. 095423.02 - Linear Delegated Design Calc's

THESE ARE TRANSMITTED as checked below:

☐ For approval ☒ Reviewed as loads only ☐ Resubmit _____ copies for approval

☒ For your use ☐ Reviewed as noted ☐ Submit _____ copies for distribution

☐ As requested ☐ Returned for corrections ☐ Return _____ corrected prints

☐ For review and comment ☐ REVISE AND RESUBMIT

☐ No Action Taken

☐ PRINTS RETURNED AFTER LOAN TO US

***** If enclosures are not as noted, kindly notify us at once. *****

REMARKS:

COPY TO: FILE

SIGNED: Cesar A. Ruiz

URGENT ☐ **Submittal CSI No.: 09510**

SUBMITTAL TRANSMITTAL

Submittal No. 095423.02 - DIVISION 9 - FINISHES - Submittal Material

Project: US Home Garage Corp Campus , WA

BLDG 4: 730 Lake Drive BLDG 5: 755 Lake Drive

Date: 02.22.2021

MG2 #: 15-0035-03

CW#: CW17-1048-03

Owner: Costco Wholesale

Contractor: Ferguson Construction

☐ **Shop Drawings** ☐ **Project Data** ☐ **Samples**

Submittal Description: Linear Metal Ceilings Delegated Design Calc's

Number of Sheets: 5 sets (see fwd log) ☐ **Catalogs / Books** **Date:** 02.22.2021

Supplier / Subcontractor / Manufacturer:

Comments / Questions:

-

Submittal Action

☐ Not Issued

☐ Under Review

☐ Approved

☐ Conforms to Design Concept

☐ Conforms to Design Concept with Revisions as Shown

☐ Non-Conforming, Revise & Re-Submit

☐ No Action Required - Submittal not required; retained for project file

Reviewer Comments:

Attachments:

Reviewed By: **Date:**

Costco Garage

09 54 23 Linear Metal Ceilings:
Delegated Design Supplemental Submittal

ENGINEERS NORTHWEST, INC. is not responsible for this design or performance of this product.

ENGINEERS NORTHWEST, INC. has reviewed the applied loads only for conformance to the construction documents and has reviewed absolutely nothing else

02-25-2021 CAR
Date By

FERGUSON CONSTRUCTION
Since 1948

REVIEWED BY John B.
SUBMITTAL # 095423.02 DATE: 2/22/2021
SUB/SUPPLIER: PCI
PROJECT: CC5

- [x] REVIEWED
- [ ] REVIEWED AS NOTED
- [ ] REVISE & RESUBMIT

FERGUSON CONSTRUCTION'S REVIEW OF THESE DOCUMENTS DOES NOT RELIEVE SUB/SUPPLIER OF ITS RESPONSIBILITY FOR:
1) FIELD VERIFICATION OF ALL DIMENSIONS AND JOB-SITE CONDITIONS AND REQUIREMENTS
2) COMPLIANCE WITH CONTRACT DOCUMENTS AND ALL APPLICABLE STATE AND CITY ORDINANCES AND REQUIREMENTS
3) COORDINATION WITH ALL TRADES.

Material Submittal

Submitted: 02/22/2021

MG2

1101 Second Ave, Ste 100
Seattle, WA 98101

Ferguson Construction, Inc.

13810 SE Eastgate Way, Suite 110
Bellevue, WA 98005

Performance Contracting, Inc.

16220 Woodinville Redmond Rd NE
Woodinville, WA 98072
Office: 425-488-7171
Fax: 425-488-4744

PCI PERFORMANCE CONTRACTING INC

SPEC SECTION NO.	09 54 23
SECTION DESCRIPTION	Linear Metal Ceilings
PROJECT	Costco Garage
PCI JOB #	20-06808

16220 Woodinville Redmond Rd NE, Woodinville, WA 98072 P: (425) 488-7171

COSTCO GARAGE INTERIOR ACT CEILING & EXTERIOR METAL PANEL CEILING ISSAQUAH, WASHINGTON

GENERAL
1. VERIFY DESIGN CRITERIA (BELOW) AND DIMENSIONS PER DRAWINGS.
2. DEVCO ENGINEERING, INC'S SCOPE OF WORK IS LIMITED TO THOSE ITEMS SHOWN ON OUR SEALED DRAWINGS. DESIGN OF ALL OTHER ITEMS IS BY OTHERS.

DESIGN CRITERIA

CEILING DEAD LOAD:	4 PSF MAX CEILING WEIGHT (ACT) 4 PSF MAX CEILING WEIGHT (METAL PANEL)
CEILING LIVE LOAD:	0 (NON ACCESSIBLE)
SEISMIC LOAD:	2015 IBC WIND V = 110MPH, EXP. = B EXTERIOR CEILING WIND PRESSURE = 17.1 PSF RISK CATEGORY: II Sds =0.634, Ip = 1.0, ap = 1.0, Rp = 2.5
DEFLECTION LIMIT:	L/360 ACT L/240 METAL PANEL

MATERIALS
1. STUD TRACK AND MISC. SHAPES TO BE MANUFACTURED FROM STEEL MEETING THE REQUIREMENTS OF ASTM A653, SS GRADE 33 FOR 43-MIL AND LIGHTER PRODUCTS AND ASTM A653, SS GRADE 50 FOR 54-MIL AND HEAVIER.
2. DESIGN BASED ON SECTION PROPERTIES FROM ICC ESR 3064P (SSMA). OTHER MANUFACTURES ARE ACCEPTABLE PROVIDING PROVISION 1 ABOVE IS MET AND SECTION PROPERTIES MEET OR EXCEED THE ABOVE LISTED ICC-ES.
3. PROVIDE PERIMETER SUPPORTING CLOSURE ANGLES PER ASCE 7-10 13.5.6.2.2. INSTALL ALL CEILINGS IN ACCORDANCE WITH ASCE 7-10 13.5.6.2 , ASTM C635 / C636, & ASTM E580.
4. WIRE TO BE GALVANIZED SOFT ANNEALED MILD STEEL WIRE AS DEFINED IN ASTM A641. USE A MINIMUM OF THREE TWISTS WITHIN 1½" LENGTH AT ENDS OF HANGER WIRE.
5. SCREWS USED IN DESIGN MEET THE REQUIREMENTS OF SECTION E4 OF THE 2012 EDITION OF THE AISI "NORTH AMERICAN SPECIFICATION FOR THE DESIGN OF COLD FORMED STEEL STRUCTURAL MEMBERS" FOR SCREW CONNECTIONS.
6. HILTI KWIK HUS-EZ (KH-EZ) CONCRETE SCREW ANCHOR, ICC ESR-3027 IN CONCRETE, ICC ESR-3056 IN MASONRY : DIAMETER AND EMBEDMENT LENGTH PER DRAWINGS. EDGE DISTANCE AND O.C. SPACING PER ICC ESR.
7. SIMPSON TITEN HD CONCRETE SCREW ANCHOR, ICC ESR-2713 IN CONCRETE, ICC ESR-1056 IN MASONRY : DIAMETER AND EMBEDMENT LENGTH PER DRAWINGS. EDGE DISTANCE AND O.C. SPACING PER ICC ESR.
8. LVF-RAMSET, ICC ESR-1799:
   P.T. SLAB IN NORMAL WEIGHT CONCRETE: 0.150"Ø x MIN. 3/4" EMBED, SPC 78. MIN. 3.5" EDGE DISTANCE, SPACING PER SECTIONS AND DETAILS, BUT NOT LESS THAN 5" O.C.

   IN CONCRETE OVER METAL DECK: 0.150"Ø x MIN. 1 1/8" EMBED, SPC 114. MIN. 3.5" EDGE DISTANCE, SPACING PER SECTIONS AND DETAILS, BUT NOT LESS THAN 5" O.C.

   MAXIMUM SPACING OF L.V.F. SHOWN ON THE DRAWINGS. IN ADDITION, PLACE ONE L.V.F. NO MORE THAN 6" FROM ANY TRACK TERMINATION.
9. LVF- HILTI, ICC-ESR-2184:
   P.T. SLAB IN NORMAL WEIGHT CONCRETE: 0.177"Ø x MIN. 7/8" EMBED, X-CX ALH 27. MIN. 3.5" EDGE DISTANCE, SPACING PER SECTIONS AND DETAILS, BUT NOT LESS THAN 5" O.C.

   IN CONCRETE OVER METAL DECK: 0.177"Ø x MIN 1" EMBED, X-CX ALH 32. MIN. 3.5" EDGE DISTANCE, SPACING PER SECTIONS AND DETAILS, BUT NOT LESS THAN 5" O.C.

   MAXIMUM SPACING OF L.V.F. SHOWN ON THE DRAWINGS. IN ADDITION, PLACE ONE L.V.F. NO MORE THAN 6" FROM ANY TRACK TERMINATION.

SHEET INDEX

This shop Drawing (product data, sample, etc.) has been prepared by Performance Contracting, Inc. in its capacity as a contractor and not as a licensed design professional. It is submitted in reliance on the accuracy of the information contained in the Contract Documents is in accordance with applicable laws, statutes, ordinances, building codes, rules and regulations and/or standards. Any comparison of Contract Documents, field measurements and observation of site conditions by Performance Contracting, Inc. has been for the sole purpose of facilitation construction and not for the purpose of discovering errors, omissions or inconsistencies with the Contract Documents.

BENJAMIN PRUETT
STATE OF WASHINGTON
55849
REGISTERED
PROFESSIONAL ENGINEER

DRAWING STATUS:	DATE:
☐ PRELIMINARY	
☒ SUBMITTED	02/08/21
☐ BID SET	
☐ PERMIT SET	
☐ CONST. SET	

No.	REVISION:	DATE:
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DEVCO engineering inc.
Corvallis Oregon
(541) 757-8991
245 NE CONIFER, P.O. BOX 1211
CORVALLIS, OR 97339
WWW.DEVCOENGINEERING.COM

PROJECT:
COSTCO GARAGE INTERIOR ACT CEILING
+ EXTERIOR METAL PANEL CEILING

PROJECT LOCATION:
ISSAQUAH, WASHINGTON

CLIENT:
PCI

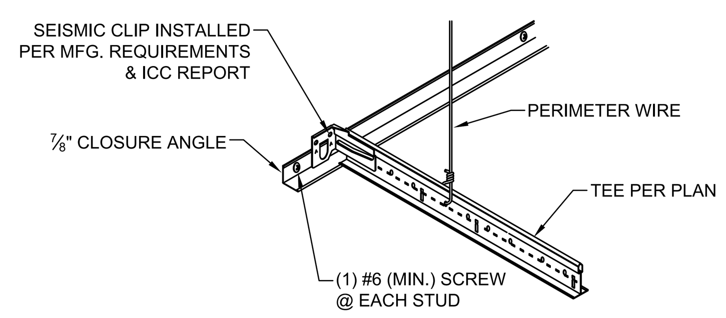
SHEET TITLE:
COVER SHEET

JOB NO. 20-086
DRAWN BY: DEVCO
DRAWING:
SF 6.00

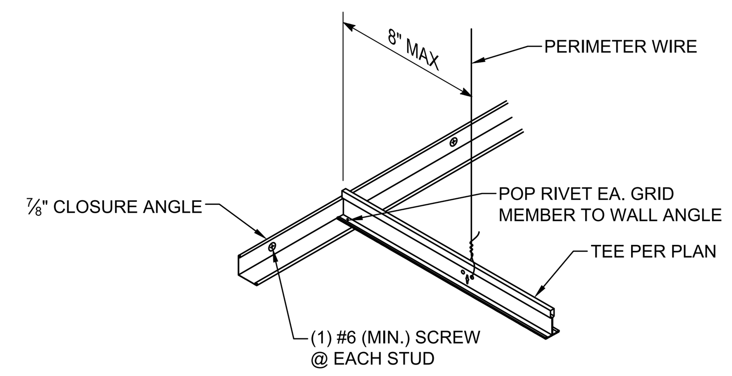
FILE: ...\20086 Costco Garage ACT\20086600.dwg 2/8/2021 12:16 PM -- Chris

INTERIOR ACT CEILING DETAILS

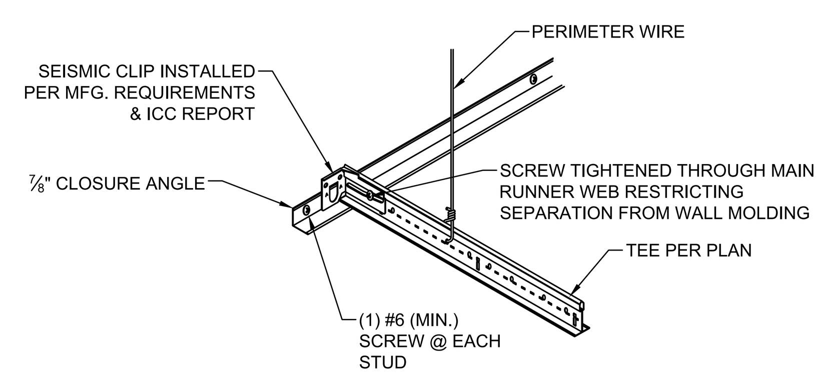
1. SEISMIC RIGID BRACING & SPLAY DETAIL PER 2 & 5/SF6.40 MAY BE USED ON EXTERIOR & INTERIOR SUSPENDED CEILINGS AS REQUIRED.
2. INTERIOR DESIGN CRITERIA SEE GENERAL NOTE SHEET SF6.00.



9C PERIMETER DETAIL - UNATTACHED WALL
SCALE: N.T.S.



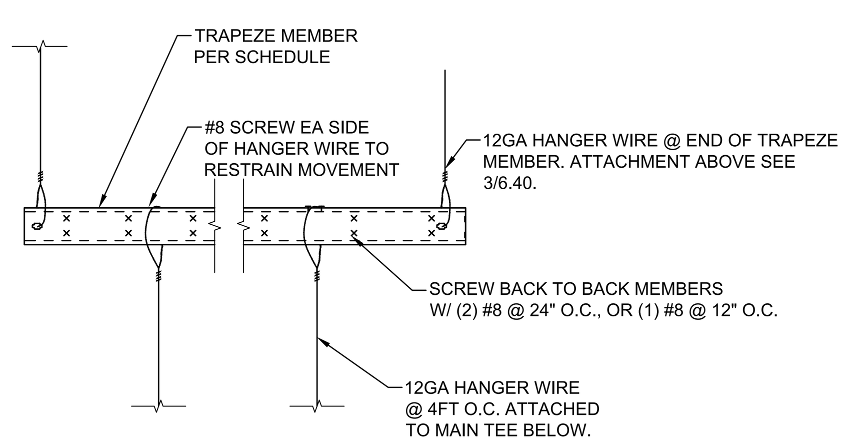
9B PERIMETER DETAIL - ATTACHED WALL OPTION 2
SCALE: N.T.S.



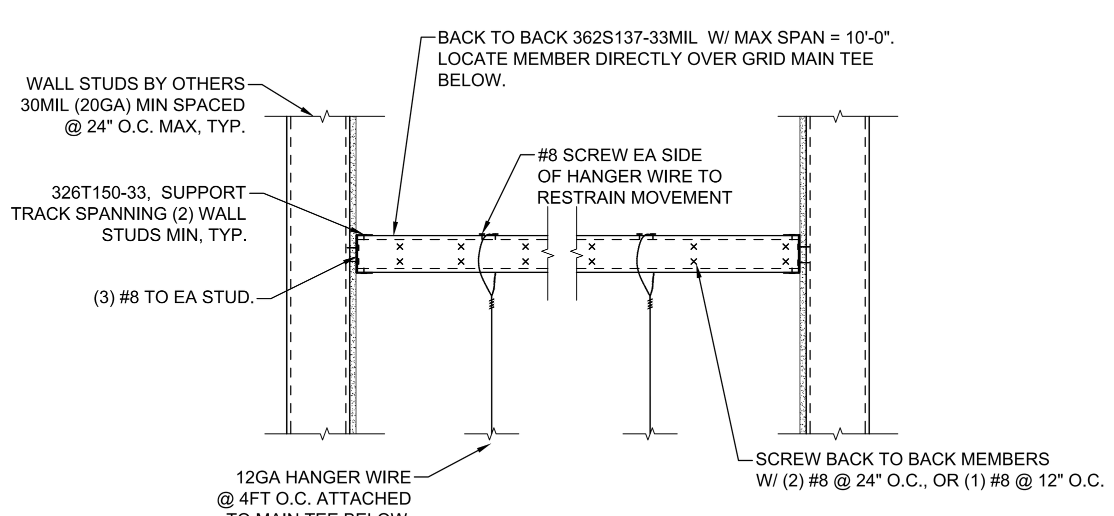
9A PERIMETER DETAIL - ATTACHED WALL OPTION 1
SCALE: N.T.S.

9 PERIMETER DETAILS
SCALE: N.T.S.

TRAPEZE MEMBER	SPAN
SINGLE 150U50-54 CRC (1 1/2" 16GA)	4'-0"
BACK TO BACK 150U50-54 CRC (1 1/2" 16GA)	4'-6"
UNISTRUT P1000	8'-0"

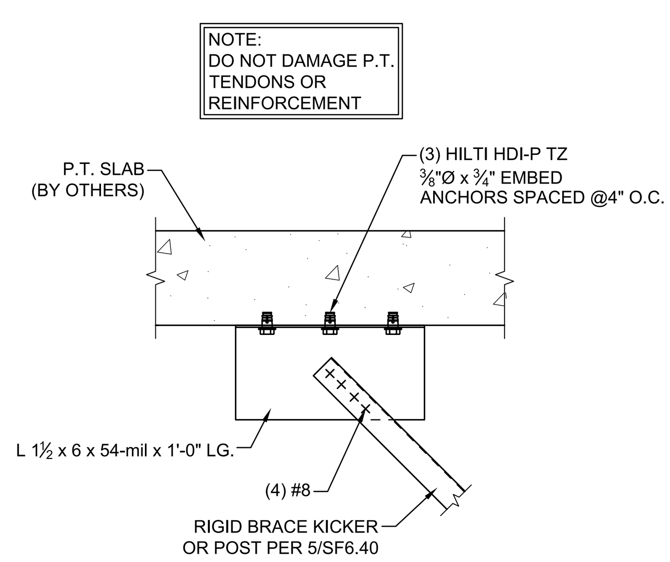


11 INTERIOR MAIN TEE SUPPORT DETAIL
SCALE: 1" = 1'-0"

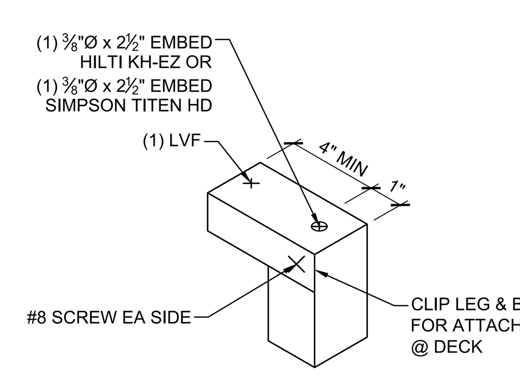


NOTES: NO SPLAYS OR COMPRESSION POSTS ATTACHED TO TRAPEZE MEMBERS

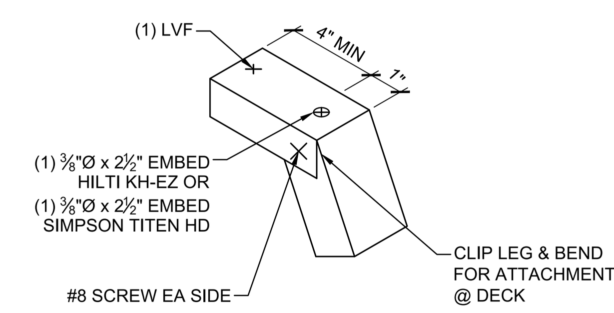
10 INTERIOR MAIN TEE SUPPORT DETAIL
SCALE: 1" = 1'-0"



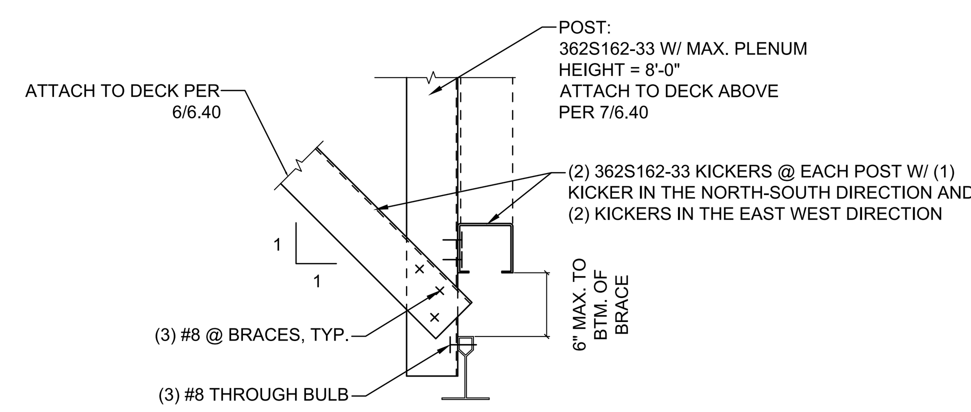
8 CONNECTION DETAIL @ P.T. SLAB
SCALE: N.T.S.



7 CONNECTION DETAIL @ CONC. DECK
SCALE: N.T.S.

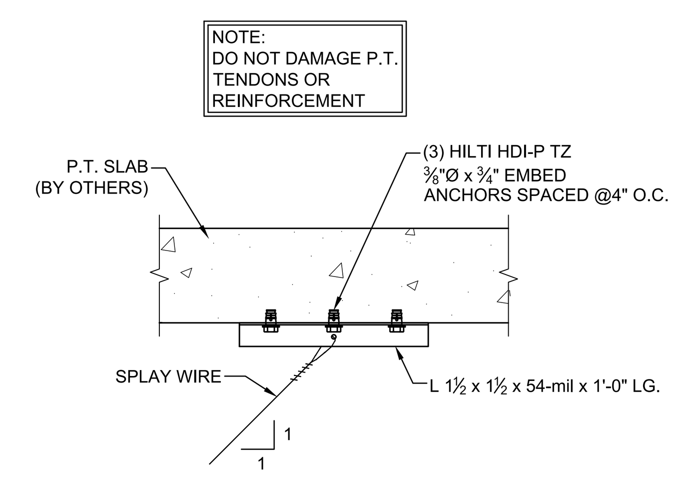


6 BRACE CONNECTION @ CONC. DECK
SCALE: N.T.S.

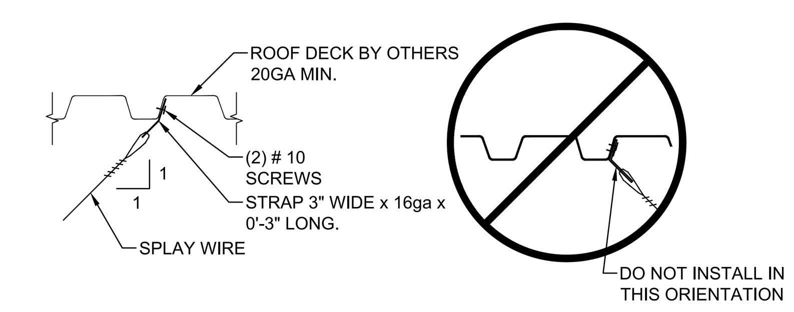


NOTES:
1. INSTALL RIGID BRACE W/ MAX SPACING @ 12' x 12' O.C. OR MAX TRIBUTARY AREA = 144 SQUARE FEET TYP, & MAX. 6'-0" FROM ANY EDGE OR ELEVATION CHANGE.
2. RIGID BRACE DETAIL MAY BE USED IN PLACE OF SPLAY WIRE BRACE DETAIL 2/6.40.
3. AT CLOUD CEILINGS "CEILINGS NOT ATTACHED TO FULL HEIGHT WALLS ON ALL 4 SIDES" INSTALL SEISMIC BRACING PER SPACING REQUIREMENTS LISTED ABOVE WITH MIN. (2) BRACES PER CEILING.

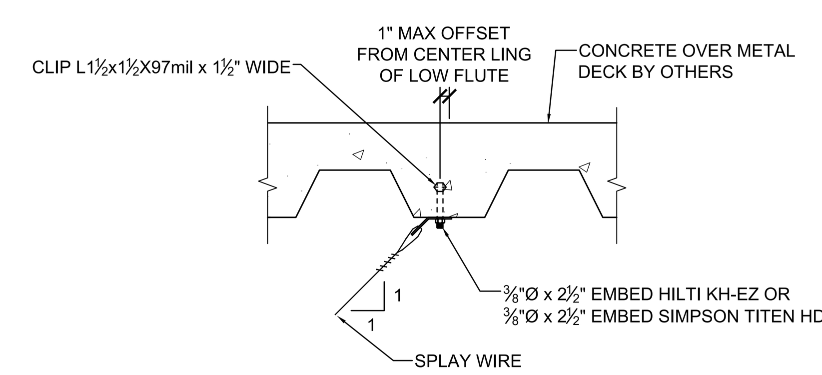
5 RIGID BRACE DETAIL
SCALE: 3"=1'-0"



4C @ P.T. SLAB
SCALE: 1 1/2" = 1'-0"

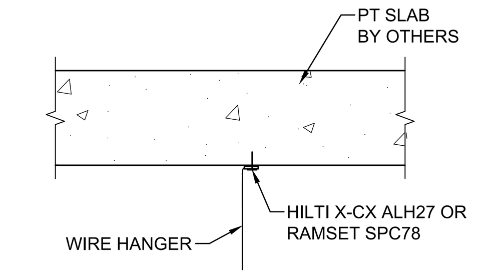


4B @ METAL ROOK DECKING
SCALE: 1 1/2" = 1'-0"

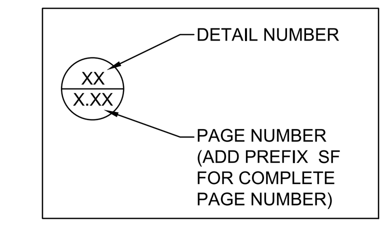


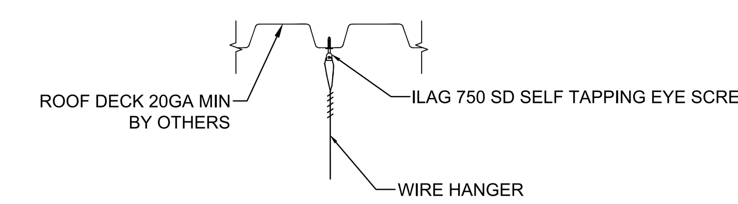
4A @ CONCRETE OVER METAL DECK
SCALE: 1 1/2" = 1'-0"

4 SPLAY WIRE CONNECTIONS
SCALE: N.T.S.

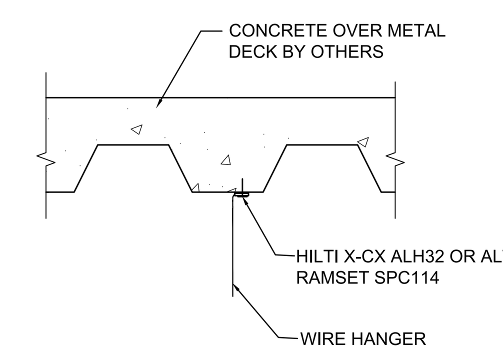


3C @ P.T. SLAB
SCALE: 1 1/2" = 1'-0"



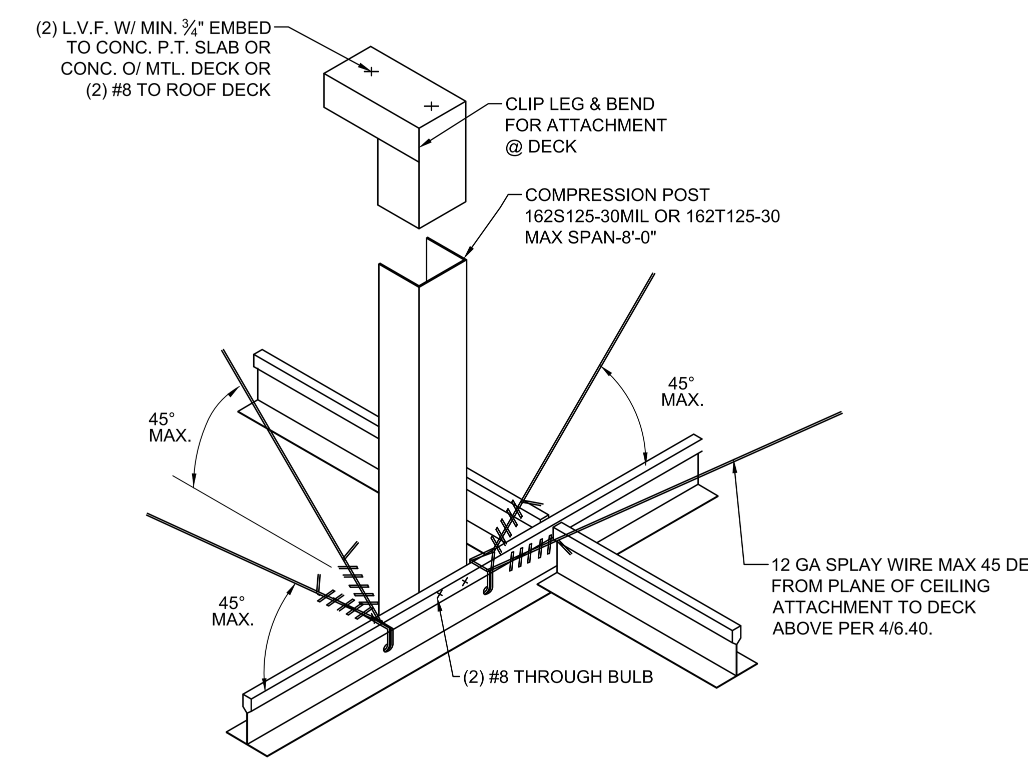


3B @ METAL ROOK DECKING
SCALE: 1 1/2" = 1'-0"



3A @ CONCRETE OVER METAL DECK
SCALE: 1 1/2" = 1'-0"

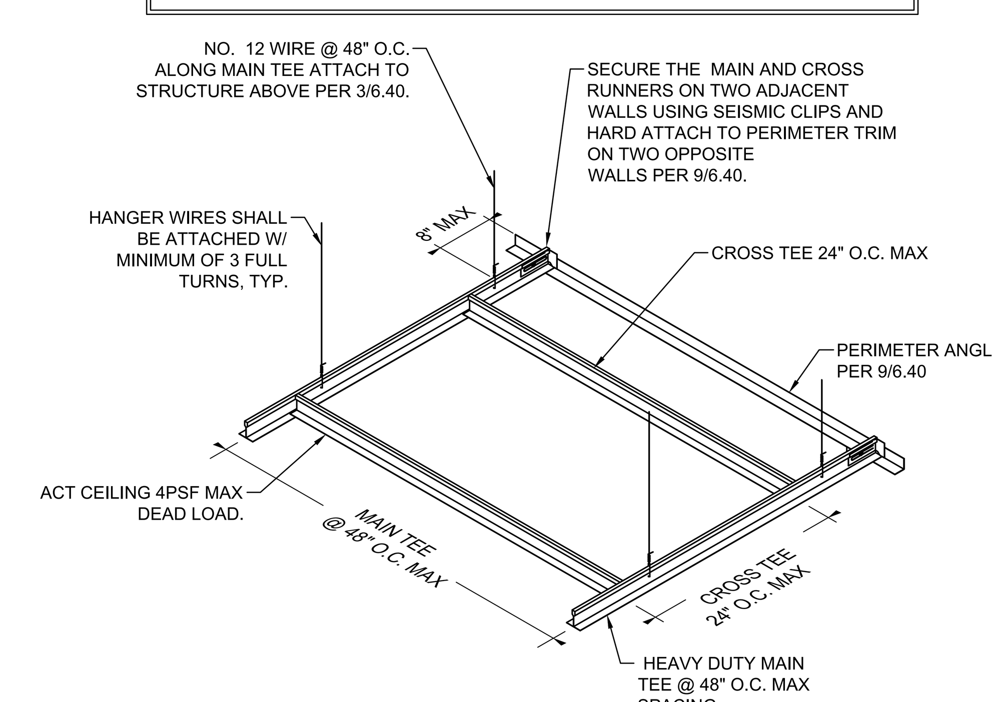
3 INTERIOR WIRE HANGER CONNECTIONS
SCALE: N.T.S.



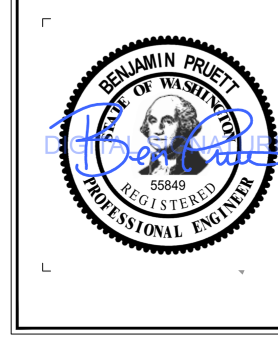
NOTE:
1. INSTALL SPLAY WIRES @ MAX 12'-0" X 12'-0" GRID OR MAX TRIBUTARY AREA = 144 SQUARE FEET TYP, & MAX 6'-0" FROM ANY EDGE OR ELEVATION CHANGE.
2. AT CLOUD CEILINGS "CEILINGS NOT ATTACHED TO FULL HEIGHT WALLS ON ALL 4 SIDES" INSTALL SEISMIC BRACING PER SPACING REQUIREMENTS LISTED ABOVE WITH MIN (2) BRACES PER CLOUD CEILING.
3. RIGID BRACE DETAIL MAY BE USED IN PLACE OF SPLAY WIRE BRACE DETAIL 2/SF6.40.

2 SPLAY WIRE & COMPRESSION POST DETAIL
SCALE: N.T.S.

NOTES:
1. FRAMING & INSTALLATION TO COMPLY WITH MANFUCATURER ICC REPORT.
2. SEISMIC SPLAY WIRES & COMPRESSION POSTS ARE REQ'D FOR CEILING AREA GREATER THAN 1000 SQUARE FEET. BRACES PER DETAIL 2/6.40. CEILINGS SURROUNDED ON ALL (4) SIDES BY FULL HEIGHT WALLS WITH A CEILING AREA OF 1000 SQUARE FEET OR LESS ARE EXEMPT FROM SEISMIC BRACING REQ'S.
3. LIGHT FIXTURE SUPPORTS PER ASTM E-580.



1 INTERIOR ACT SUSPENDED CEILING GRID SYSTEM
SCALE: N.T.S.



DRAWING STATUS:	DATE:	No.	REVISION:	DATE:
PRELIMINARY				
☒ SUBMITTED	02/08/21			
BID SET				
PERMIT SET				
CONST. SET				

DEVCO engineering inc.
Corvallis Oregon
(541) 757-8991
245 NE CONIFER, P.O. BOX 1211
CORVALLIS, OR 97339
WWW.DEVCOENGINEERING.COM

PROJECT:
COSTCO GARAGE INTERIOR ACT CEILING + EXTERIOR METAL PANEL CEILING
PROJECT LOCATION:
ISSAQUAH, WASHINGTON
CLIENT:
PCI

SHEET TITLE:
INT. ACT FRAMING DETAILS

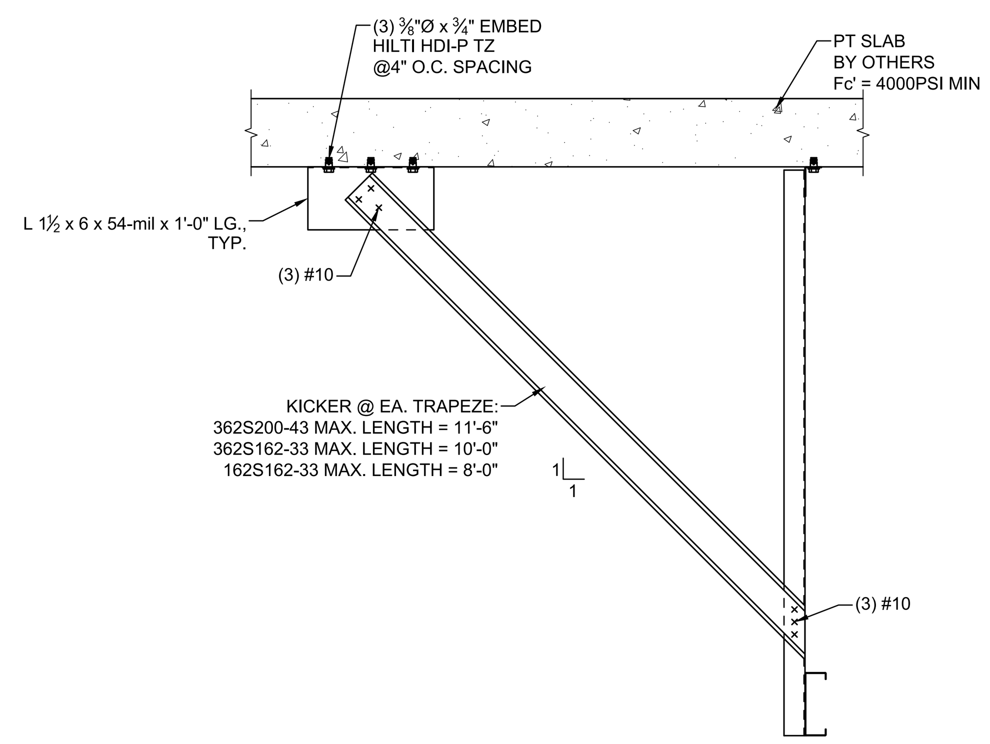
JOB NO. 20-086
DRAWN BY: DEVCO
DRAWING:
SF 6.40

FILE: J:\20\000\20086 Costco Garage ACT\20086640.dwg 1/20/2021 3:37 PM -- Chris

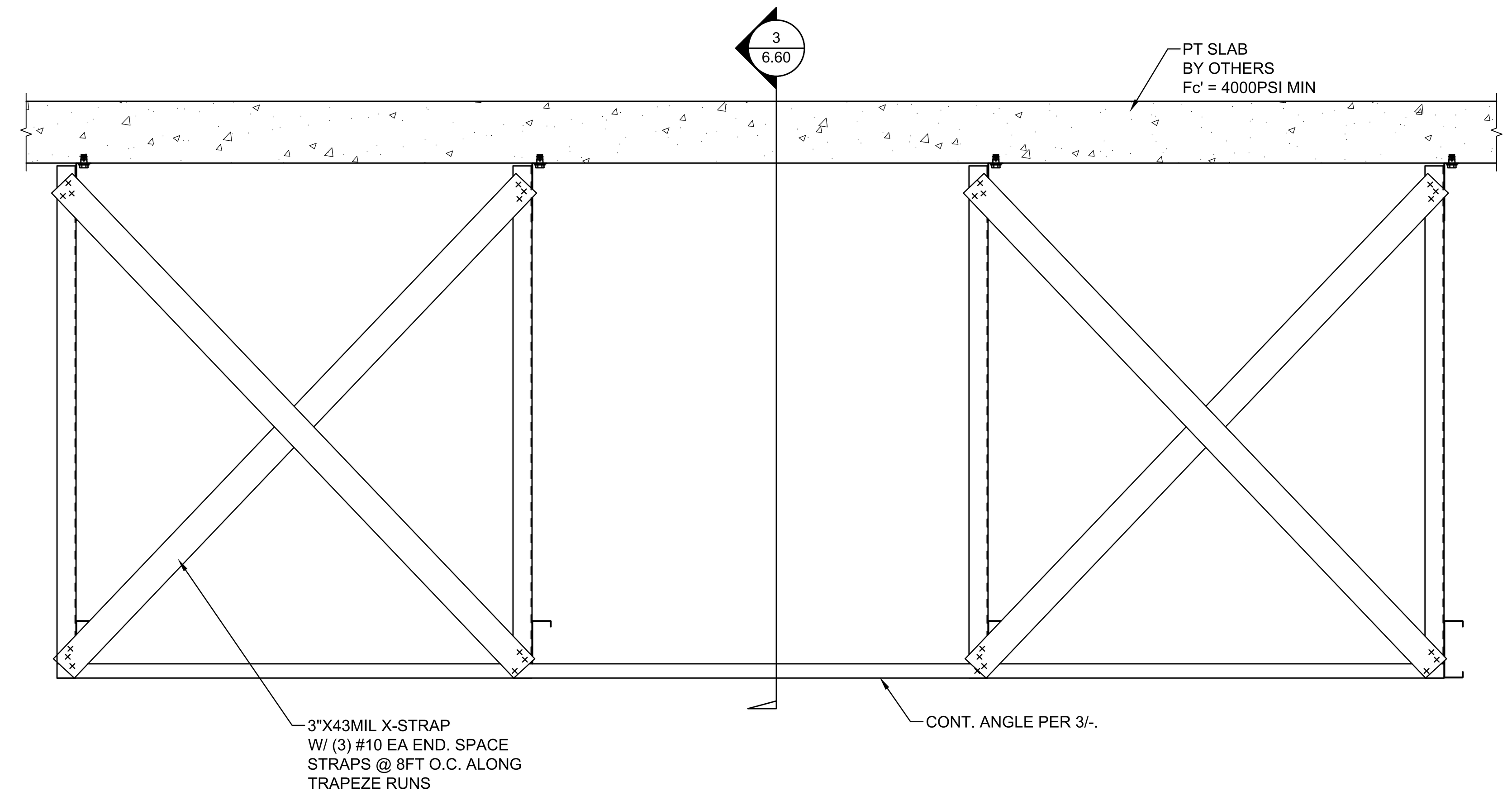
EXTERIOR METAL PANEL CEILING DETAILS

1. SEISMIC RIGID BRACING & SPLAY DETAIL PER 2 & 5/SF6.40 MAY BE USED ON EXTERIOR & INTERIOR SUSPENDED CEILINGS AS REQUIRED.
2. EXTERIOR DESIGN CRITERIA SEE GENERAL NOTE SHEET SF6.00.

XX — DETAIL NUMBER
X.XX — PAGE NUMBER (ADD PREFIX SF FOR COMPLETE PAGE NUMBER)

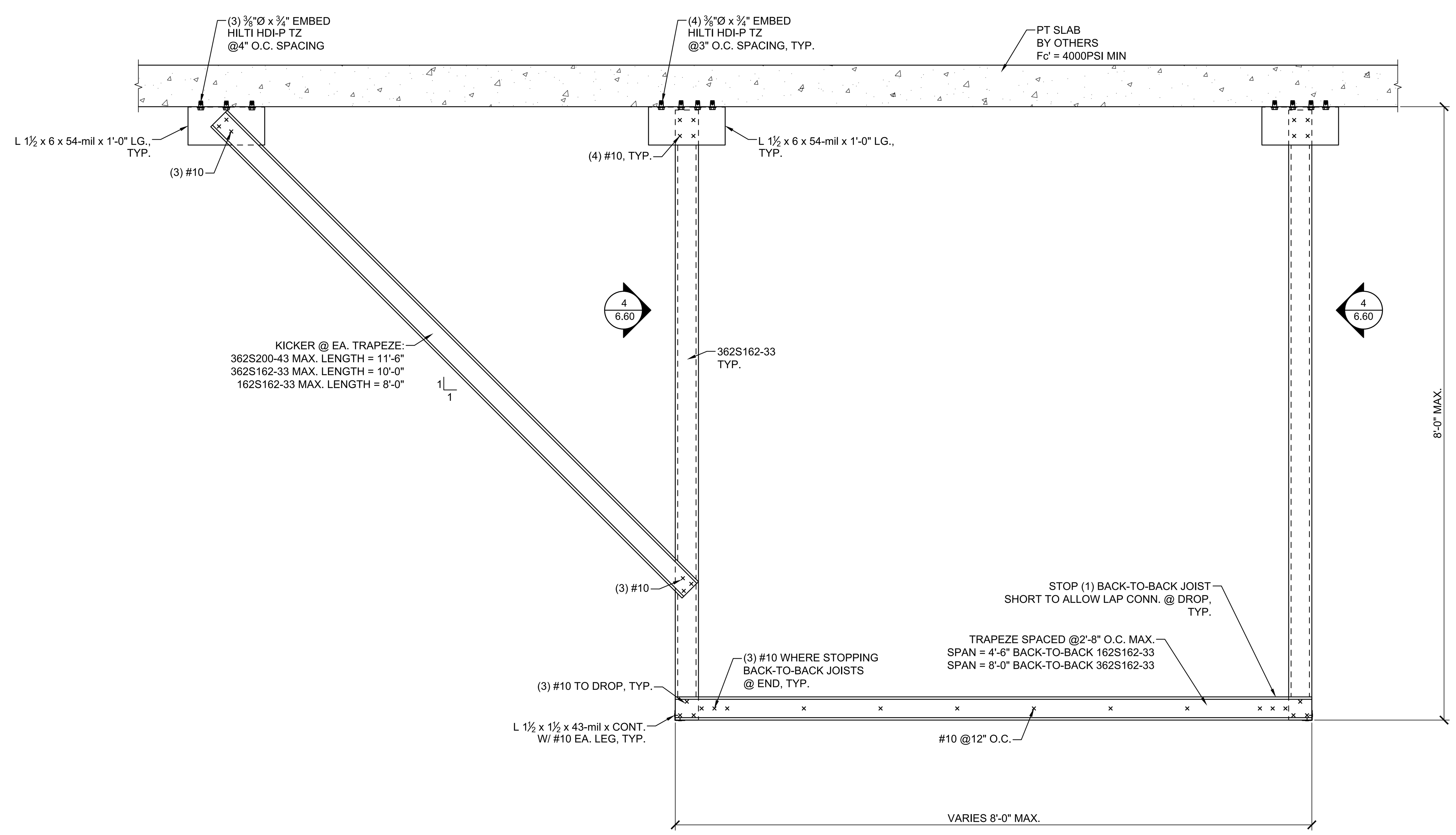


4B SINGLE TRAPEZE BRACING
SCALE: 1" = 1'-0"

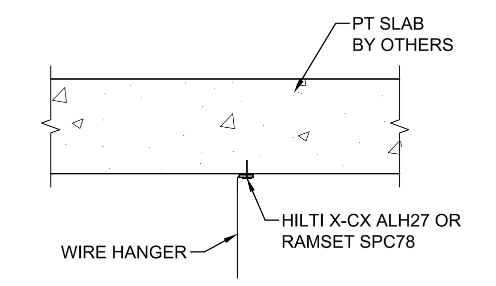


4A MULTIPLE TRAPEZE W/ X-STRAP BRACING
SCALE: 1" = 1'-0"

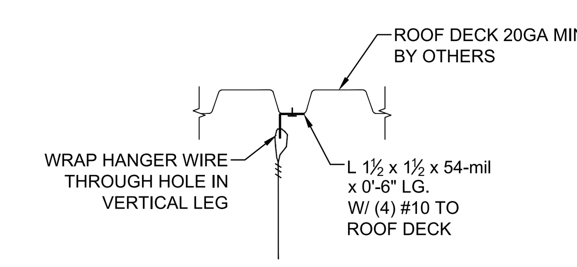
4 EXTERIOR TRAPEZE
SCALE: 1" = 1'-0"



3 EXTERIOR TRAPEZE
SCALE: 1" = 1'-0"



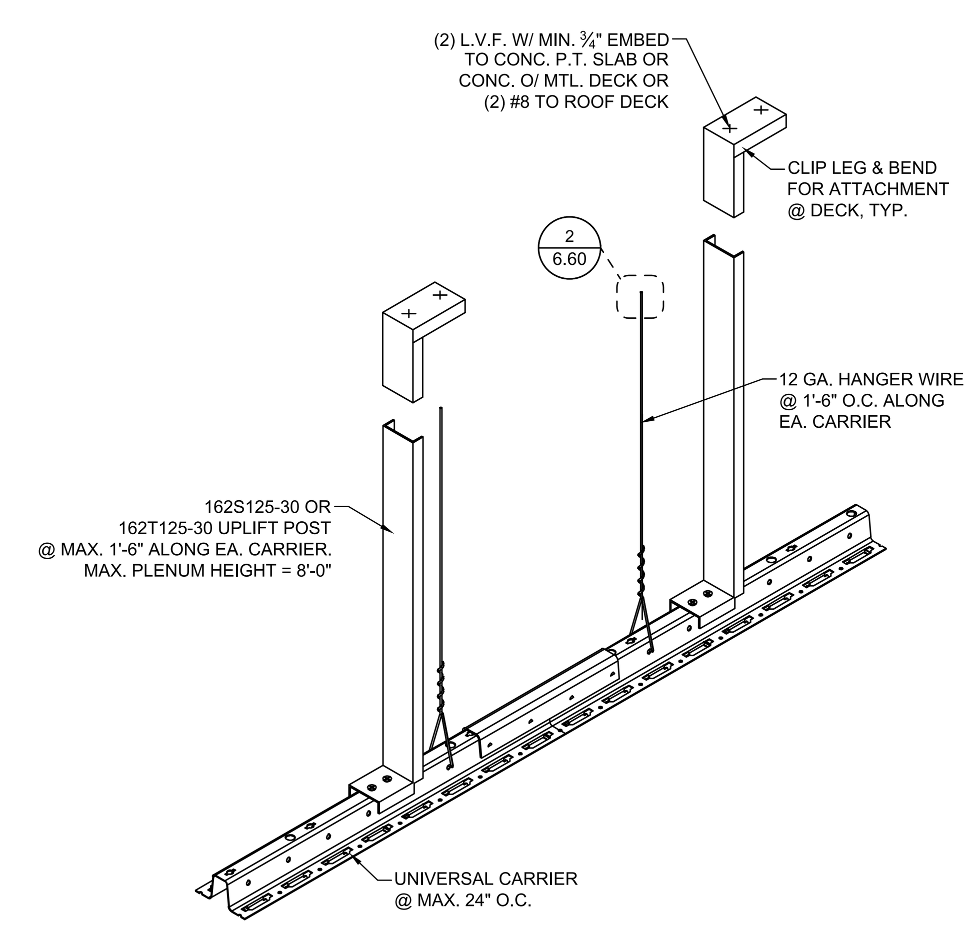
2B @ P.T.SLAB
SCALE: 1 1/2" = 1'-0"



2A @ METAL DECK
SCALE: 1 1/2" = 1'-0"

2 HANGER WIRE TOP CONN. @ EXTERIOR
SCALE: 1 1/2" = 1'-0"

NOTE:
SEISMIC SPLAY BRACING REQUIRED PER 2/6.40.
UPLIFT POST CAN BE USED AS COMPRESSION POST IN SPLAY BRACING DETAIL.



1 UNIVERSAL CARRIER SPLICE @ EXTERIOR
SCALE: N.T.S.

DRAWING STATUS:	DATE:
PRELIMINARY	
☒ SUBMITTED	02/08/21
BID SET	
PERMIT SET	
CONST. SET	

No.	REVISION:	DATE:
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DEVCO engineering inc.
245 NE CONIFER, P.O. BOX 1211
CORVALLIS, OR 97339
WWW.DEVCOENGINEERING.COM
Corvallis Oregon (541) 757-8991

PROJECT:
COSTCO GARAGE INTERIOR ACT CEILING + EXTERIOR METAL PANEL CEILING

PROJECT LOCATION:
ISSAQUAH, WASHINGTON

CLIENT:
PCI

SHEET TITLE:
EXT. ACT FRAMING DETAILS

JOB NO. 20-086
DRAWN BY: DEVCO
DRAWING:
SF 6.60

CEMCO®
Expanding Your Solutions

Corporate Headquarters
13191 Crossroads Pkwy N., Ste 325
City of Industry, CA 91746
Phone: 800.775.2362
Fax: 626.330.7598
www.cemcosteel.com

Manufacturing Facilit
City of Industry, CA
Denver, CO
Ft. Worth, TX
Pittsburg, CA

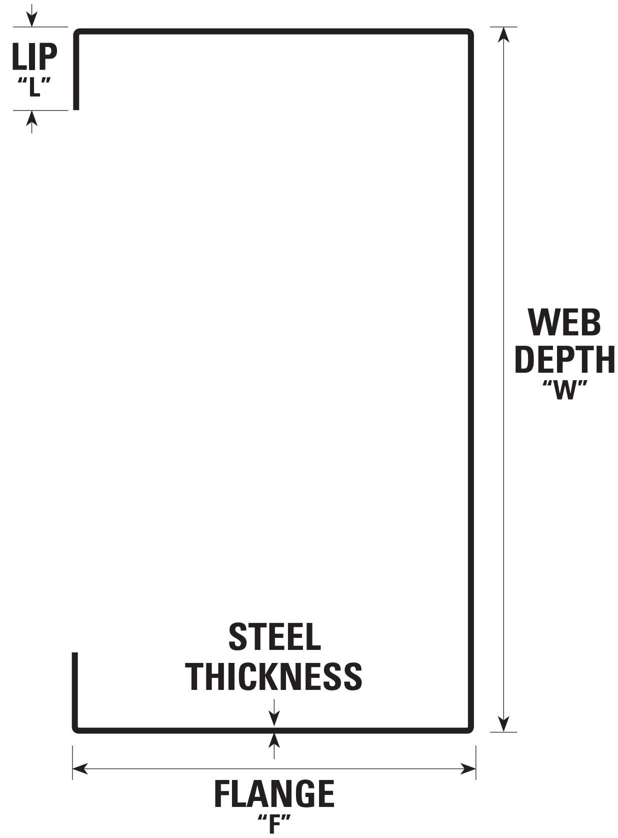
1001-A Pittsburgh Antioch Hwy
Pittsburg, CA 94565
Phone: 800.775.2362
Fax: 626.330.7598
www.cemcoengineering.com

13191 Crossroads Pkwy N., Ste 325
City of Industry, CA 91746
Phone: 800.416.2278
Fax: 626.249.5004

362S200-43 C-STUDS 43 MIL. (18 GA. STRUCTURAL)

Geometric Properties

362S200-43 "S" structural load-bearing studs are produced from hot-dipped galvanized steel in standard CP60 coating. CP90 is available upon special request, and may require up-charges and extended lead times.



Physical Properties

Model No.	Design Thickness (in)	Minimum Thickness (in)	Yield (ksi)	Coating[3,4]	Web Depth (in)	Flange Size (in)	Lip (in)
362S200-43	0.0451	0.0428	33	CP60	3-5/8	2	5/8

Notes:
1. Uncoated steel thickness. Thickness is for carbon sheet steel.
2. Minimum thickness represents 95% of the design thickness and is the minimum acceptable thickness.
3. Per ASTM C955 & A1003, Table 1.
4. CP90 available upon request. Will require extended lead time and upcharge.

Color Code (painted on ends): 43-mil: Yellow

ASTM & Code Standards:

- ASTM A653/A653M, A924/A924M, A1003/1003, C955 & C1007
- ICC-ES & SFIA Code Compliance Certification Program
- ICC ESR-3016
- ATI CCRR-0224
- IBC: 2012, 2015, 2018
- CBC: 2013, 2016
- AISI: S100-07, S100-12, S100-16, S200-12, S240-15

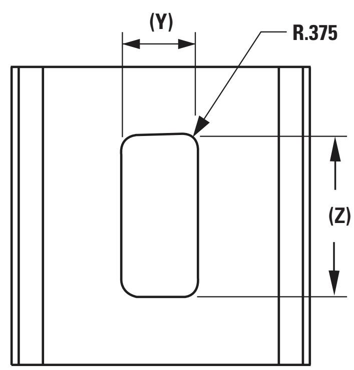
LEED v4 for Building and Design Construction

- MR Prerequisite: Construction and Demolition Waste Management Planning.
- MR Credit: Construction and Demolition Waste Management.
- MR Credit: Building Product Disclosure and Optimization – Sourcing of Raw Materials, Option 2.
- MR Credit: Building Product Disclosure and Optimization – Environmental Product Declarations, Options 1 & 2.
- MR Credit: Building Product Disclosure and Optimization – Material Ingredients, Option 1.
- MR Credit: Building Life-Cycle Impact Reduction, Option 4.

CEMCO cold-formed steel framing products contain 30% to 37% recycled steel.

- Total Recycled Content: 36.9%
- Post-Consumer: 19.8%
- Pre-Consumer: 14.4%

CSI Division: 05.40.00 – Cold-Formed Metal Framing



Hole Detail

Standard Hole Centers are 24"	(Z) (in)	(Y) (in)
2-1/2" studs	2.000	0.750
3-1/2" to 14" studs	3.250	1.500

362S200-43 Section Properties

Design Thickness (in.)	Fy (ksi)	Gross[3] Ix (in^4)	Gross Sx (in^3)	Gross Rx (in)	Gross Iy (in^4)	Gross Ry (in)	Effective Properties[2] Ix (in^4)	Effective Sx (in^3)	Effective Ma (in-k)	Effective Vag (lb)	Effective Vanet (lb)	Effective Mad (in-k)	Torsional Properties Jx1000 (in^4)	Torsional Cw (in^6)	Torsional Xo (in)	Torsional m (in)	Torsional Ro (in)	Torsional ß	Lu (in)
0.0451	33	0.836	0.461	1.474	0.227	0.767	0.836	0.427	8.43	1739	676	8.70	0.261	0.734	-1.729	1.024	2.398	0.480	53.5

Notes: 1. Web depth for track sections equals nominal depth plus 2 times the design thickness plus bend radius. **2.** The values are for members with punch-outs. **3.** Gross properties are based on the full, unreduced cross-section, away from web punchouts. **4.** Use the effective moment of inertia for deflection calculation. **5.** Allowable moment is lesser of Ma and Mad. Distortional buckling is based on an assumed $K\phi = 0$. **6.** These members are available un-punched only.

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12-04-18 AT

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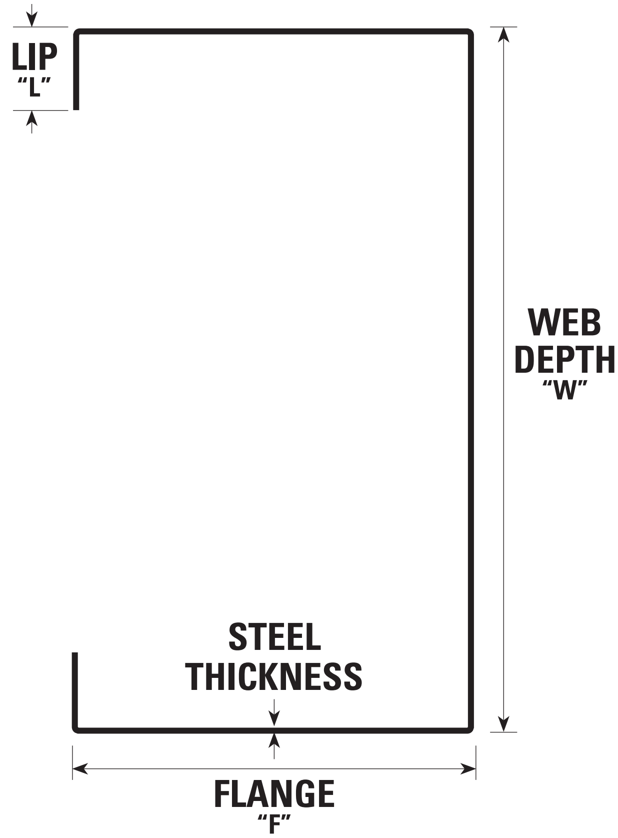
362S162-33 C-STUDS 33 MIL. (20 GA. STRUCTURAL)



Geometric Properties

362S162-33 "S" structural load-bearing studs are produced from hot-dipped galvanized steel in standard CP60 coating. CP90 is available upon special request, and may require up-charges and extended lead times.

Physical Properties

Model No.	Design Thickness (in)	Minimum Thickness (in)	Yield (ksi)	Coating[3,4]	Web Depth (in)	Flange Size (in)	Lip (in)
362S162-33	0.0346	0.0329	33	CP60	3-5/8	1-5/8	1/2

Notes:
1. Uncoated steel thickness. Thickness is for carbon sheet steel.
2. Minimum thickness represents 95% of the design thickness and is the minimum acceptable thickness.
3. Per ASTM C955 & A1003, Table 1.
4. CP90 available upon request. Will require extended lead time and upcharge.

Color Code (painted on ends): 33-mil: White

ASTM & Code Standards:

- ASTM A653/A653M, A924/A924M, A1003/1003, C955 & C1007
- ICC-ES & SFIA Code Compliance Certification Program
- ICC ESR-3016
- ATI CCRR-0224
- IBC: 2012, 2015, 2018
- CBC: 2013, 2016
- AISI: S100-07, S100-12, S100-16, S200-12, S240-15

LEED v4 for Building and Design Construction

- MR Prerequisite: Construction and Demolition Waste Management Planning.
- MR Credit: Construction and Demolition Waste Management.
- MR Credit: Building Product Disclosure and Optimization – Sourcing of Raw Materials, Option 2.
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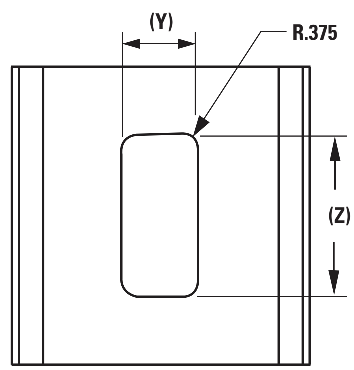
CEMCO cold-formed steel framing products contain 30% to 37% recycled steel.

- Total Recycled Content: 36.9%
- Post-Consumer: 19.8%
- Pre-Consumer: 14.4%

CSI Division: 05.40.00 – Cold-Formed Metal Framing



Hole Detail

Standard Hole Centers are 24"	(Z) (in)	(Y) (in)
2-1/2" studs	2.000	0.750
3-1/2" to 14" studs	3.250	1.500

362S162-33 Section Properties

Design Thickness (in.)	Fy (ksi)	Gross[3]					Effective Properties[2]						Torsional Properties						Lu (in)
		Ix (in^4)	Sx (in^3)	Rx (in)	Iy (in^4)	Ry (in)	Ix (in^4)	Sx (in^3)	Ma (in-k)	Vag (lb)	Vanet (lb)	Mad (in-k)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	m (in)	Ro (in)	ß	
0.0346	33	0.551	0.304	1.450	0.099	0.616	0.551	0.268	5.29	1024	521	5.43	0.105	0.297	-1.308	0.789	2.048	0.592	42.6

Notes: 1. Web depth for track sections equals nominal depth plus 2 times the design thickness plus bend radius. **2.** The values are for members with punch-outs. **3.** Gross properties are based on the full, unreduced cross-section, away from web punchouts. **4.** Use the effective moment of inertia for deflection calculation. **5.** Allowable moment is lesser of Ma and Mad. Distortional buckling is based on an assumed $K\phi = 0$. **6.** These members are available un-punched only.

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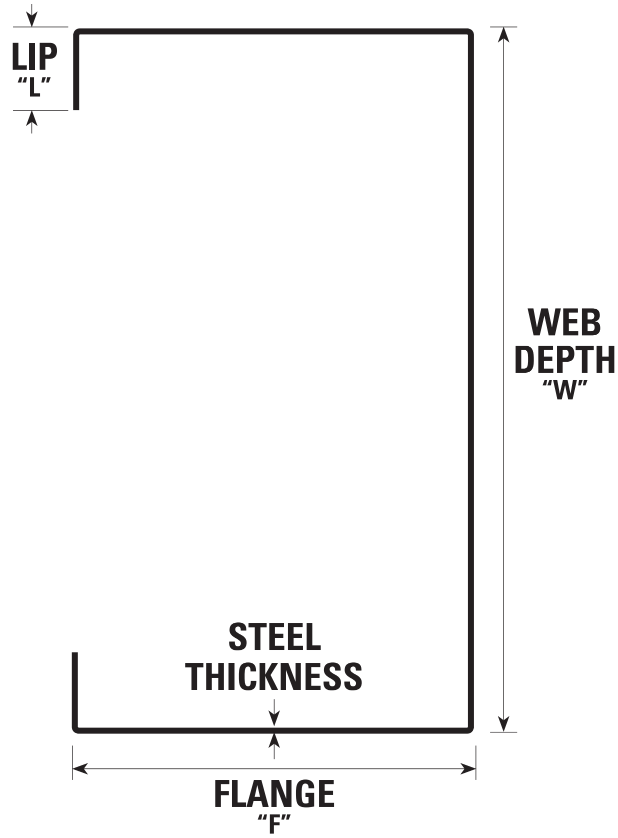
Fax: 626.249.5004

362S137-33 C-STUDS 33 MIL. (20 GA. STRUCTURAL)

Geometric Properties

362S137-33 "S" structural load-bearing studs are produced from hot-dipped galvanized steel in standard CP60 coating. CP90 is available upon special request, and may require up-charges and extended lead times.



Physical Properties

Model No.	Design Thickness (in)	Minimum Thickness (in)	Yield (ksi)	Coating[3,4]	Web Depth (in)	Flange Size (in)	Lip (in)
362S137-33	0.0346	0.0329	33	CP60	3-5/8	1-3/8	3/8

Notes:
1. Uncoated steel thickness. Thickness is for carbon sheet steel.
2. Minimum thickness represents 95% of the design thickness and is the minimum acceptable thickness.
3. Per ASTM C955 & A1003, Table 1.
4. CP90 available upon request. Will require extended lead time and upcharge.

Color Code (painted on ends): 33-mil: White

ASTM & Code Standards:

- ASTM A653/A653M, A924/A924M, A1003/1003, C955 & C1007
- ICC-ES & SFIA Code Compliance Certification Program
- ICC ESR-3016
- ATI CCRR-0224
- IBC: 2012, 2015, 2018
- CBC: 2013, 2016
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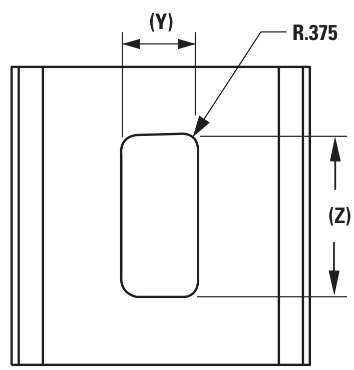

Hole Detail

Standard Hole Centers are 24"	(Z) (in)	(Y) (in)
2-1/2" studs	2.000	0.750
3-1/2" to 14" studs	3.250	1.500

362S137-33 Section Properties

Design Thickness (in.)	Fy (ksi)	Gross[3]					Effective Properties[2]						Torsional Properties						Lu (in)
		Ix (in^4)	Sx (in^3)	Rx (in)	Iy (in^4)	Ry (in)	Ix (in^4)	Sx (in^3)	Ma (in-k)	Vag (lb)	Vanet (lb)	Mad (in-k)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	m (in)	Ro (in)	ß	
0.0346	33	0.479	0.264	1.424	0.059	0.501	0.479	0.232	4.59	1024	521	4.72	0.094	0.165	-1.003	0.615	1.813	0.694	34.7

Notes: **1.** Web depth for track sections equals nominal depth plus 2 times the design thickness plus bend radius. **2.** The values are for members with punch-outs. **3.** Gross properties are based on the full, unreduced cross-section, away from web punchouts. **4.** Use the effective moment of inertia for deflection calculation. **5.** Allowable moment is lesser of Ma and Mad. Distortional buckling is based on an assumed $K\phi = 0$. **6.** These members are available un-punched only.

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162VS125-30 VIPERSTUD

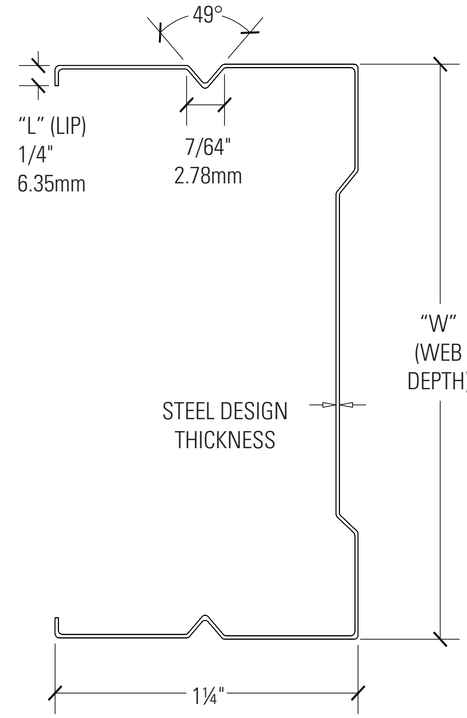
Geometric Properties

1-5/8" x 1-1/4" flange, 30 mil ViperStuds are manufactured from standard G40 hot-dipped galvanized steel. G60 and G90 coatings are available through special order, and may require up-charges and extended lead times.

Steel Thickness

Model No.	Design Thickness (in)	Minimum Thickness (in)	Yield (ksi)	"W" Web Sizes (in)	Coating[4,5]	Flange (in)	"L" Return Lip (in)
162VS125-30	0.0312	0.0296	33	1-5/8	G40	1-1/4	1/4

Notes: 1. Uncoated steel thickness. Thickness is for carbon sheet steel. **2.** Minimum thickness represents 95% of the design thickness and is the minimum acceptable thickness. **3.** Knockout size for 1-5/8" Stud is 3/4" x 1-3/4". **4.** Per ASTM C645 & A1003, Table 1. **5.** G60 and G90 available upon request. Will require extended lead time and upcharge.



Color Code (painted on ends): 30 mil: Pink

ASTM & Code Standards:

- ASTM A653/A653M, A924/A924M, A1003/1003, C645 & C754
- ICC-ES & SFIA Code Compliance Certification Program
- ICC ESR-2620
- ATI CCRR-0224
- IBC: 2012, 2015, 2018
- CBC: 2013, 2016
- AISI: S100-07, S100-12, S100-16, S220-11, S220-15

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- MR Credit: Building Life-Cycle Impact Reduction, Option 4.

162VS125-30 ViperStud Properties

				Gross Properties					Effective Properties		Moment				
Design (in)	Min (in)	Yield (ksi)	Weight (lb/ft)	Area (in^2)	Ix (in^4)	rx (in)	Iy (in^4)	ry (in)	Ixd (in^4)	Sx (in^3)	Allowable Moment Ma (in-k)	Local Buckling Nominal Moment[2] Viper Mnl (in-k)	Distortional Buckling Nominal Moment[2] Viper Mnd (in-k)	Nominal Moment for Conventional Studs[3] Mn (in-k)	Critical Unbraced Length[7] Lu (in)
0.0312	0.0296	33	0.46	0.135	0.062	0.680	0.028	0.455	0.062	0.067	1.32	2.21	2.38	1.99 (30 mil)	30.8

Notes: 1. Section properties are in accordance with AISI S100-07/ S1-10 . Viper 25 and Viper20 section properties are based on testing. Allowable moment (Ma) is calculated in accordance with Chapter F of AISI S100-07/ S1-10 specification. **2.** Nominal moment for Viper 18 mil, Viper 30 mil, and Viper 33 mil conventional studs are based on calculations in accordance with AISI S100-07/ S1-10. Allowable moments (Ma) can be calculated with a 1.67 safety factor. **3.** Section properties are in accordance with AISI S100-07 with S1-10 and AISI S220-11. **4.** Web depth-to-thickness ratio exceeds 200. **5.** Web depth-to-thickness ratio exceeds 260. **6.** ViperStud is considered fully braced when unbraced length is less than listed Lu. **7.** KΦ assumed to be zero for distortional buckling moments.

Non-Composite Limiting Heights – Braced at 48" O.C.

Depth (in)	Gauge	Member Designation	Design (in)	Min (in)	Yield (ksi)	Spacing (o.c.)	5 PSF L/120	5 PSF L/240	5 PSF L/360	7.5 PSF L/120	7.5 PSF L/240	7.5 PSF L/360	10 PSF L/120	10 PSF L/240	10 PSF L/360
1-5/8	20	162VS125-30	0.0312	0.0296	33	12	11'-10"	9'-4"	8'-2"	10'-4"	8'-2"	7'-1"	8'-11" f	7'-5"	6'-6"
		162VS125-30	0.0312	0.0296	33	16	10'-8"	8'-6"	7'-5"	8'-11" f	7'-5"	6'-6"	7'-8" f	6'-8"	--
		162VS125-30	0.0312	0.0296	33	24	8'-11" f	7'-5"	6'-6"	7'-4" f	6'-6"	--	6'-4" f	--	--

Notes: 1. Limiting heights are in accordance with AISI S100-07 using all steel non-composite design. **2.** Limiting heights are established by considering flexure, shear, web crippling, and deflection. The web crippling values are based on testing with a bearing length of 1". **3.** For bending, studs are assumed to be adequately braced to develop full allowable moment. Studs are considered fully braced when unbraced length is less the Lu. **4.** Viper25 & Viper20 distortional & local buckling moments and stiffness are based on testing in accordance with App. A of a non-structural code compliance program. **5.** For web crippling, when h/t≤ 200, the web crippling values are computed based on section C3.4.2 of AISI S100-07., when h/t>200, the web crippling values are based on testing with a bearing length of 1" and fastened to support. **6.** Web stiffeners are required for studs with h/t≥ 200, web crippling and shear values have been confirmed by testing. **Fully braced when unbraced length is less than Lu. See section properties table for Lu values.**

7. The factory punchouts are in accordance with section C5 of AISI S201-07. The distance from the center of the last punchout to the end of the stud is 12".

"f" - flexure controls; "s" - shear controls; "w" - web crippling controls. No letter next to the number means deflection controls.

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162VS125-30 VIPERSTUD

Non-Composite Limiting Heights – Fully Braced

Depth (in)	Gauge	Member Designation	Design (in)	Min (in)	Yield (ksi)	Spacing (o.c.)	5 PSF			7.5 PSF			10 PSF		
							L/120	L/240	L/360	L/120	L/240	L/360	L/120	L/240	L/360
1-5/8	20	162VS125-30	0.0312	0.0296	33	12	11'-8"	9'-4"	8'-1"	10'-2"	8'-1"	7'-1"	9'-4"	7'-5"	6'-6"
		162VS125-30	0.0312	0.0296	33	16	10'-8"	8'-6"	7'-5"	9'-4"	7'-5"	6'-6"	8'-1" f	6'-8"	--
		162VS125-30	0.0312	0.0296	33	24	9'-4"	7'-5"	6'-6"	7'-8" f	6'-6"	--	6'-7" f	--	--

Notes: 1. Limiting heights are in accordance with AISI S100-07 using all steel non-composite design. **2.** Limiting heights are established by considering flexure, shear, web crippling, and deflection. The web crippling values are based on testing with a bearing length of 1". **3.** For bending, studs are assumed to be adequately braced to develop full allowable moment. Studs are considered fully braced when unbraced length is less the Lu. **4.** Viper25 & Viper20 distortional & local buckling moments and stiffness are based on testing in accordance with App. A of a non-structural code compliance program. **5.** For web crippling, when h/t≤ 200, the web crippling values are computed based on section C3.4.2 of AISI S100-07., when h/t>200, the web crippling values are based on testing with a bearing length of 1" and fastened to support. **6.** No web stiffeners are required for studs with h/t>200, web crippling and shear values have been confirmed by testing. **Fully braced when unbraced length is less than Lu. See section properties table for Lu values.** **7.** The factory punchouts are in accordance with section C5 of AISI S201-07. The distance from the center of the last punchout to the end of the stud is 12".

"f" - flexure controls; "s" - shear controls; "w" - web crippling controls. No letter next to the number means deflection controls.

Allowable Composite Heights for Non-Load Bearing Walls

Depth (in)	Gauge	Member Designation	Design (in)	Min (in)	Yield (ksi)	Spacing (o.c.)	5 PSF			7.5 PSF			10 PSF		
							L/120	L/240	L/360	L/120	L/240	L/360	L/120	L/240	L/360
1-5/8	20	162VS125-30	0.0312	0.0296	33	12	14'-7"	11'-6"	10'-0"	12'-9"	10'-0"	8'-6"	11'-7"	8'-11"	--
		162VS125-30	0.0312	0.0296	33	16	13'-3"	10'-5"	8'-11"	11'-7"	8'-11"	--	10'-6"	7'-10"	--
		162VS125-30	0.0312	0.0296	33	24	11'-7"	8'-11"	--	10'-1"	--	--	8'-10"	--	--

Notes: 1. Viper composite limiting heights are based on testing in accordance with ICC-ES acceptance criteria AC86-2012.
2. No screws are required between stud and track, except as required by ASTM C754. Composite heights are based on using standard top track. Screw fastening of stud to track is not required. Mechanically fastening of gypsum panel to the stud and track is required.
3. Viper composite limiting heights based on single layer of 5/8" Type X gypsum board applied vertically to both sides of the wall over fill height. 5/8" Type X wallboard from the following manufacturers are acceptable: USG, National, Georgia-Pacific, Temple Inland, CertainTeed, American, and LaFarge.

Allowable Ceiling Spans

L/240		4 PSF Lateral Support of Compression Flange						6 PSF Lateral Support of Compression Flange					
Member	Fy ksi	Unsupported Joist Spacing (in.) O.C.			Midspan Joist Spacing (in.) O.C.			Unsupported Joist Spacing (in.) O.C.			Midspan Joist Spacing (in.) O.C.		
		12	16	24	12	16	24	12	16	24	12	16	24
162VS125-30	33	9'-4"f	8'-7"f	7'-8"f	10'-1"	9'-2"	8'-0"	8'-4"f	7'-8"f	6'-10"f	8'-10"	8'-0"	7'-0"

L/360		4 PSF Lateral Support of Compression Flange						6 PSF Lateral Support of Compression Flange					
Member	Fy ksi	Unsupported Joist Spacing (in.) O.C.			Midspan Joist Spacing (in.) O.C.			Unsupported Joist Spacing (in.) O.C.			Midspan Joist Spacing (in.) O.C.		
		12	16	24	12	16	24	12	16	24	12	16	24
162VS125-30	33	8'-10"	8'-0"	7'-0"	8'-10"	8'-0"	7'-0"	7'-8"	7'-0"	6'-1"	7'-8"	7'-0"	6'-1"

Notes: 1. Ceiling Spans are in accordance with AISI S100-07/S1-10 using all steel non-composite design. **2.** Ceiling Spans are established by considering flexure, shear, web crippling, and deflection. **3.** For web crippling, when h/t ≤ 200, the web crippling values are computed based on section C3.4.2 of AISI S100-07. When h/t > 200, the web crippling values are based on testing with a bearing length of 1". **4.** No web stiffeners are required for studs with h/t > 200, web crippling and shear values have been confirmed by testing. **5.** All values are for simple spans, with compression flange either unbraced or braced at mid-span. **6.** Ceiling spans are based on total load of assembly, not including storage or live load for accessible ceilings. **7.** The factory punchouts are in accordance with section C5 of AISI S201-07. The distance from the center of the last punchout to the end of the stud is 12".

"f" - flexure controls; "s" - shear controls; "w" - web crippling controls. No letter next to the number means deflection controls.

CEMCO cold-formed steel framing products contain 30% to 37% recycled steel.

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- Pre-Consumer: 14.4%

CSI Division:

- 09.22.16 – Non-Structural Metal Framing

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13191 Crossroads Pkwy N., Ste 325
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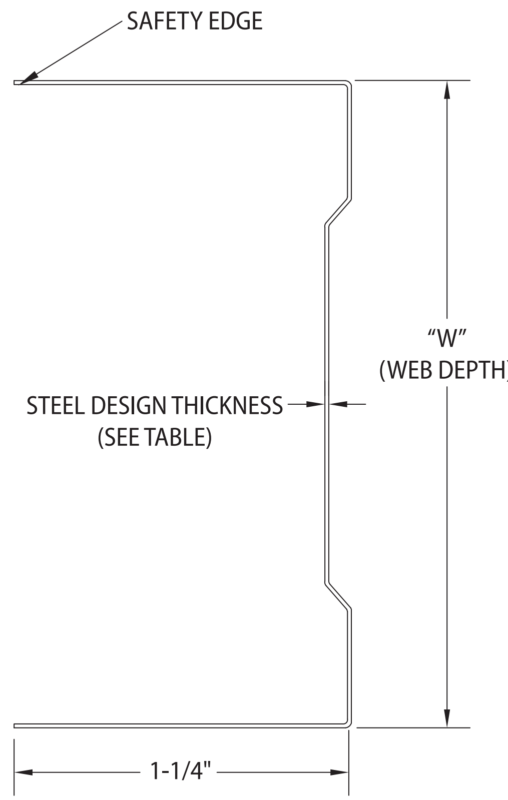
162VT125-30 VIPERTRACK

Geometric Properties

1-5/8" X 1-1/4" flange 30 mil ViperTracks are manufactured from standard G40 hot-dipped galvanized steel. G60 and G90 coatings are available through special order, and may require up-charges and extended lead times.



Steel Thickness

Model No.	Design Thickness (in)	Minimum Thickness (in)	Yield (ksi)	Web Depth (W) (in)	Coating[4]	Flange (in)
162VT125-30	0.0312	0.0296	33	1-5/8	G40	1-1/4

Notes:
1. Uncoated steel thickness. Thickness is for carbon sheet steel.
2. Minimum thickness represents 95% of the design thickness and is the minimum acceptable thickness.
3. Per ASTM C645 & A1003.
4. G60 and G90 available upon request. Will require extended lead time and upcharge.

Color Code (painted on ends): 30 mil: Pink

ASTM & Code Standards:

- ASTM A653/A653M, A924/A924M, A1003/1003, C645 & C754
- ICC-ES & SFIA Code Compliance Certification Program
- ICC ESR-2620
- ATI CCRR-0224
- IBC: 2012, 2015, 2018
- ATI CCRR-0154
- CBC: 2013, 2016
- AISI: S100-07, S100-12, S100-16, S220-11, S220-15

LEED v4 for Building and Design Construction

- MR Prerequisite: Construction and Demolition Waste Management Planning.
- MR Credit: Construction and Demolition Waste Management.
- MR Credit: Building Product Disclosure and Optimization – Sourcing of Raw Materials, Option 2.
- MR Credit: Building Product Disclosure and Optimization – Environmental Product Declarations, Options 1 & 2.
- MR Credit: Building Product Disclosure and Optimization – Material Ingredients, Option 1.
- MR Credit: Building Life-Cycle Impact Reduction, Option 4.

CEMCO cold-formed steel framing products contain 30% to 37% recycled steel.

- Total Recycled Content: 36.9%
- Post-Consumer: 19.8%
- Pre-Consumer: 14.4%

Interior Non-Load Bearing Track Section Properties

Member	Leg Size (in)	Weight (lb/ft)	Design (in)	Min (in)	Yield (ksi)	Gross Properties: Area (in^2)	Ix (in^4)	Sx (in^3)	Rx (in)	Iy (in^4)	Sy (in^3)	Ry (in)	Effective Properties: Ixd (in^4)	Sxe (in^3)	Ma (in-k)	Torsional Properties: Xo (in)	Jx103 (in^4)	Cw (in)	Ro (in)	ß
162VT125-30	1.25	0.44	0.0312	0.0296	33	0.129	0.071	0.080	0.741	0.022	0.0249	0.409	0.056	0.051	1.00	-0.868	0.0419	0.012	1.21	0.488

Notes:
1. Section properties are in accordance with AISI S100-16.
2. Cold-work of forming is not included.
3. The effective moment of inertia for deflection is calculated based on AISI S100-16 procedure 1 for serviceability determination.
4. The center line bend radius is greater than 2 times the design thickness or 3/32".

CEMCO®
Expanding Your Solutions

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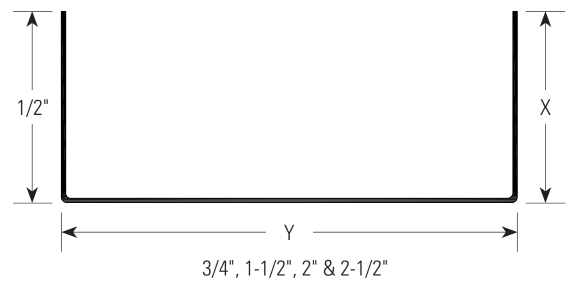
"U" - UNPUNCHED U-SHAPED CHANNEL • 1-1/2" x 54 Mil.

Geometric Properties

1-1/2" "U" channels are fabricated in 1/2" legs. All CEMCO U-Shaped channels are produced from hot-dipped galvanized steel in standard G60 coating. G90 is available upon special request.



Steel Thickness

Thickness (mil)	Design Thickness (in)[1]	Minimum Thickness (in)[1,2]
54	0.0566 (1.44 mm)	0.0538 (1.37 mm)

Notes: 1. Uncoated Steel Thickness. Thickness is for carbon sheet steel. **2.** Minimum Thickness represents 95% of the design thickness and is the minimum acceptable thickness delivered to the job site, based on Section A4.3 of the AISI S100-2007.

Color Code (painted on ends): 54-mil: Green

ASTM & Code Standards:

- ASTM A653/A653M, 924/A924M, A1003/1003, C955 & C1007
- ICC-ES & SFIA Code Compliance Certification Program
- ICC ESR-3016
- ATI CCRR-0224
- IBC: 2012, 2015, 2018
- CBC: 2013, 2016
- AISI: S100-07, S100-12, S100-16, S200-12, S240-15

CSI Division: 05.40.00 – Cold-Formed Metal Framing

LEED v4 for Building and Design Construction

- MR Prerequisite: Construction and Demolition Waste Management Planning.
- MR Credit: Construction and Demolition Waste Management.
- MR Credit: Building Product Disclosure and Optimization – Sourcing of Raw Materials, Option 2.
- MR Credit: Building Product Disclosure and Optimization – Environmental Product Declarations, Options 1 & 2.
- MR Credit: Building Product Disclosure and Optimization – Material Ingredients, Option 1.
- MR Credit: Building Life-Cycle Impact Reduction, Option 4.

CEMCO cold-formed steel framing products contain 30% to 37% recycled steel.

- Total Recycled Content: 36.9%
- Post-Consumer: 19.8%
- Pre-Consumer: 14.4%

Ask for SAFETY EDGED BY CEMCO

U-Channel Section Properties

Section	Design Thickness (in)	Gross Properties: Area (in²)	Weight (lb/ft)	Ix (in⁴)	Rx (in)	Iy (in⁴)	Ry (in)	Effective Properties: Ix (in⁴)	Sx (in³)	Ma (in-k)	Va (lbs)
150U050-54	0.0566	0.129	0.44	0.039	0.547	0.003	0.144	0.039	0.052	1.22	840

Notes: 1. For Deflection calculations, use effective Ixx.

U-Shaped Channels Allowable Ceiling Spans

Section			Uniform Load: 4 psf Channel Spacing o.c. (in)					6 psf Channel Spacing o.c. (in)					13 psf Channel Spacing o.c. (in)				
			24	36	48	60	72	24	36	48	60	72	24	36	48	60	72
150U050-54	L/240	Single	5'-6"	4'-10"	4'-5"	4'-1"	3'-10"	4'-10"	4'-3"	3'-10"	3'-7"	3'-5"	3'-9"	3'-3"	3'-0"	2'-9"	2'-7"
		Multiple	7'-1"	6'-2"	5'-8"	5'-3"	4'-11"	6'-2"	5'-5"	4'-11"	4'-7"	4'-4"	4'-10"	4'-2"	3'-9"	3'-4"	3'-0"
	L/360	Single	5'-6"	4'-10"	4'-5"	4'-1"	3'-10"	4'-10"	4'-3"	3'-10"	3'-7"	3'-5"	3'-9"	3'-3"	3'-0"	2'-9"	2'-7"
		Multiple	7'-1"	6'-2"	5'-8"	5'-3"	4'-11"	6'-2"	5'-5"	4'-11"	4'-7"	4'-4"	4'-10"	4'-2"	3'-9"	3'-4"	3'-0"

Notes:
1. Fy = 50 ksi for all sections.
2. Multiple span indicates two or more equal spans with channel continuous over interior supports.
2. Bearing Lengths = 0.75".
3. Allowable spans based on the compression flange laterally unbraced.

Product Submittal Sheet

SCAFCO Steel Stud Company

Spokane Washington Manufacturing Facility
2800 East Main Avenue, Spokane, WA 99202
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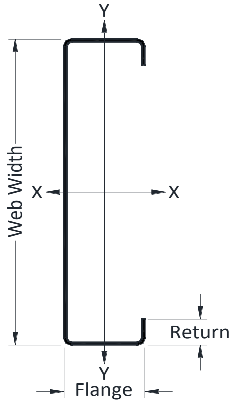
Stockton California Manufacturing Facility
2525 South Airport Way, Stockton, CA 95206
Phone: 209.670.8053 Fax: 209.670.8057

362S200-43

Product Information

The structural stud is fabricated from prime mill certified steel with a true galvanized coating.
Heavier coatings may be available upon request.



Steel Material Properties

43 Mil	Labeled Thickness
0.0451"	Design Thickness
0.0428"	Minimum Thickness
33 ksi	Yield Strength (Fy)
45 ksi	Tensile Strength (Fu)
G60	Galvanize Coating Thickness
Yellow	Color Code (Painted Ends)

Geometric Properties

3-5/8"	Web Width
2"	Flange Height
5/8"	Return Length

LEED - Contributing Credits

All SCAFCO materials have a high inherent recycled steel content.

- LEED 2009 - MRc2 (2 points) & MRc4 (2 points)
- LEED v4 - MR Credits - EPD (2 points) - Waste Management (2 points) - Sourcing of Raw Materials (1 point) - Material Ingredients (1 point) - Innovation (2 points)

Recycled Content of Steel

- 14.4% Pre-Consumer Scrap Recycled Content
- 19.8% Post-Consumer Scrap Recycled Content
- 36.9% Total Recycled Content

ASTM and AISI Code Standards

- ASTM A653/A653M, A924/A924M, A1003, C645, C754, C955, C1007
- AISI NASPEC 2007 Edition S100-07 (Supplement S2-10 for IBC 2012)
- 2012, 2015 International Building Codes and 2010, 2013 CBC

SCAFCO Technical Services

For additional information, visit www.SCAFCO.com or contact technical services at 509-343-9000 or technical@SCAFCO.com

IAPMO UNIFORM ER 0313

ICC ES ESR-3064P

SSMA

Section Properties

Table Notes:

1. The centerline bend radius is based on inside corner radii.
2. Effective properties incorporate the strength increase from the cold work of forming as applicable per AISI S100 A7.2.
3. Tabulated gross properties are based on the full-unreduced cross section of the studs away from punch-out's.
4. For deflection calculations, use the effective moment of inertia.
5. Allowable moment is the lesser of Mal and Mad. Stud distortional buckling is based on an assumed Kϕ = 0.

Section	Gross Properties							Effective and Distortional Properties						Torsional Properties						Lu (in)
	Area (in^2)	Weight (lb/ft)	Ix (in^4)	Sx (in^3)	Rx (in)	Iy (in^4)	Ry (in)	Ixe (in^4)	Sxe (in^3)	Mal (in-k)	Mad (in-k)	Vag (lb)	VaNet (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	m (in)	Ro (in)	ß	
362S200-43	0.385	1.31	0.836	0.461	1.474	0.227	0.767	0.836	0.427	8.43	8.70	1739	676	0.261	0.734	-1.729	1.024	2.398	0.480	53.5

Limiting Wall Heights

Table Notes:

1. Listed wind pressures represent calculated designed wind pressure (1.0 W based on 2009 or 0.6 W based on 2012 IBC). For deflection calculations, listed wind pressures have been reduced by 0.70 as allowed by IBC. The 5 psf pressure has not been reduced for deflection checks.
2. Studs must be braced against rotation and lateral movement at all supports.
3. Studs are assumed to be adequately braced at a maximum spacing of Lu to develop full allowable moment.
4. Web crippling check is based on 1" of bearing at end supports and 3" of bearing at interior support.
5. Shear and web crippling capacity at end supports have not been reduced for punch-out's. Shear and web crippling capacity at interior support have been reduced for the presence of punch-out adjacent to the support.
4. Combined bending and shear check at interior support is based on unreinforced web per AISI S100 (Eq. C3.3.1-1). Shear capacity and combined bending and shear check at interior support have been reduced for the presence of punch-out's adjacent to support.

Stud Spacing (in)	Non-Composite Fully Braced (5 psf)			Non-Composite Fully Braced (15 psf)			Non-Composite Fully Braced (20 psf)		
	L/120	L/240	L/360	L/240	L/360	L/600	L/240	L/360	L/600
12" o.c.	28' 0"	22' 3"	19' 5"	17' 4"	15' 2"	12' 9"	15' 9"	13' 9"	11' 7"
16" o.c.	25' 5"	20' 2"	17' 8"	15' 9"	13' 9"	11' 7"	14' 4"	12' 6"	10' 7"
24" o.c.	22' 3"	17' 8"	15' 5"	13' 8"	12' 0"	10' 2"	11' 10"	10' 11"	9' 3"

Product Submittal Sheet

SCAFCO Steel Stud Company

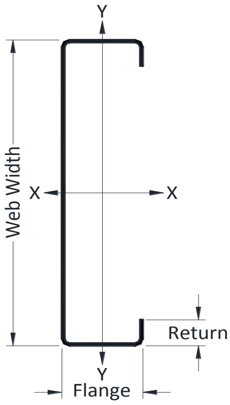
Spokane Washington Manufacturing Facility
2800 East Main Avenue, Spokane, WA 99202
Phone: 509.343.9000 Fax: 509-343-9060

Stockton California Manufacturing Facility
2525 South Airport Way, Stockton, CA 95206
Phone: 209.670.8053 Fax: 209.670.8057

362S162-33

Product Information

The structural stud is fabricated from prime mill certified steel with a true galvanized coating. Heavier coatings may be available upon request.



Steel Material Properties

33 Mil	Labeled Thickness
0.0346"	Design Thickness
0.0329"	Minimum Thickness
33 ksi	Yield Strength (Fy)
45 ksi	Tensile Strength (Fu)
G60	Galvanize Coating Thickness
White	Color Code (Painted Ends)

Geometric Properties

3-5/8"	Web Width
1-5/8"	Flange Height
1/2"	Return Length

LEED - Contributing Credits

All SCAFCO materials have a high inherent recycled steel content.

- LEED 2009 - MRc2 (2 points) & MRc4 (2 points)
- LEED v4 - MR Credits - EPD (2 points) - Waste Management (2 points) - Sourcing of Raw Materials (1 point) - Material Ingredients (1 point) - Innovation (2 points)

Recycled Content of Steel

- 14.4% Pre-Consumer Scrap Recycled Content
- 19.8% Post-Consumer Scrap Recycled Content
- 36.9% Total Recycled Content

ASTM and AISI Code Standards

- ASTM A653/A653M, A924/A924M, A1003, C645, C754, C955, C1007
- AISI NASPEC 2007 Edition S100-07 (Supplement S2-10 for IBC 2012)
- 2012, 2015 International Building Codes and 2010, 2013 CBC

SCAFCO Technical Services

For additional information, visit www.SCAFCO.com or contact technical services at 509-343-9000 or technical@SCAFCO.com

IAPMO UNIFORM ER 0313

ICC ES ESR-3064P

SSMA

Section Properties

Table Notes:

1. The centerline bend radius is based on inside corner radii.
2. Effective properties incorporate the strength increase from the cold work of forming as applicable per AISI S100 A7.2.
3. Tabulated gross properties are based on the full-unreduced cross section of the studs away from punch-out's.
4. For deflection calculations, use the effective moment of inertia.
5. Allowable moment is the lesser of Mal and Mad. Stud distortional buckling is based on an assumed Kϕ = 0.

Section	Gross Properties							Effective and Distortional Properties						Torsional Properties						Lu (in)
	Area (in^2)	Weight (lb/ft)	Ix (in^4)	Sx (in^3)	Rx (in)	Iy (in^4)	Ry (in)	Ixe (in^4)	Sxe (in^3)	Mal (in-k)	Mad (in-k)	Vag (lb)	VaNet (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	m (in)	Ro (in)	ß	
362S162-33	0.262	0.89	0.551	0.304	1.450	0.099	0.616	0.551	0.268	5.29	5.43	1024	521	0.105	0.297	-1.308	0.789	2.048	0.592	42.6

Limiting Wall Heights

Table Notes:

1. Listed wind pressures represent calculated designed wind pressure (1.0 W based on 2009 or 0.6 W based on 2012 IBC). For deflection calculations, listed wind pressures have been reduced by 0.70 as allowed by IBC. The 5 psf pressure has not been reduced for deflection checks.
2. Studs must be braced against rotation and lateral movement at all supports.
3. Studs are assumed to be adequately braced at a maximum spacing of Lu to develop full allowable moment.
4. Web crippling check is based on 1" of bearing at end supports and 3" of bearing at interior support.
5. Shear and web crippling capacity at end supports have not been reduced for punch-out's. Shear and web crippling capacity at interior support have been reduced for the presence of punch-out adjacent to the support.
4. Combined bending and shear check at interior support is based on unreinforced web per AISI S100 (Eq. C3.3.1-1). Shear capacity and combined bending and shear check at interior support have been reduced for the presence of punch-out's adjacent to support.

Stud Spacing (in)	Non-Composite Fully Braced (5 psf)			Non-Composite Fully Braced (15 psf)			Non-Composite Fully Braced (20 psf)		
	L/120	L/240	L/360	L/240	L/360	L/600	L/240	L/360	L/600
12" o.c.	24' 4"	19' 4"	16' 11"	15' 1"	13' 2"	11' 1"	13' 3"	12' 0"	10' 1"
16" o.c.	22' 2"	17' 7"	15' 4"	13' 3"	12' 0"	10' 1"	11' 6"	10' 11"	9' 2"
24" o.c.	18' 9"	15' 4"	13' 5"	10' 10"	10' 6"	8' 10"	9' 5" e	9' 5" e	8' 0"

"e" web stiffeners required at ends.

SCAFCO Steel Stud Company

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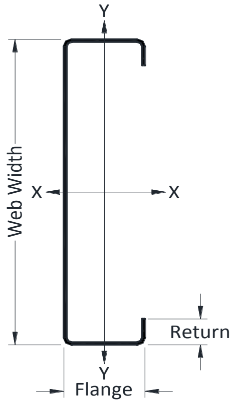
Phone: 209.670.8053 Fax: 209.670.8057

362S137-33

Product Information

The structural stud is fabricated from prime mill certified steel with a true galvanized coating.
Heavier coatings may be available upon request.



Steel Material Properties

33 Mil	Labeled Thickness
0.0346"	Design Thickness
0.0329"	Minimum Thickness
33 ksi	Yield Strength (Fy)
45 ksi	Tensile Strength (Fu)
G60	Galvanize Coating Thickness
White	Color Code (Painted Ends)

Geometric Properties

3-5/8"	Web Width
1-3/8"	Flange Height
3/8"	Return Length

LEED - Contributing Credits

All SCAFCO materials have a high inherent recycled steel content.

- LEED 2009 - MRc2 (2 points) & MRc4 (2 points)
- LEED v4 - MR Credits - EPD (2 points) - Waste Management (2 points) - Sourcing of Raw Materials (1 point) - Material Ingredients (1 point) - Innovation (2 points)

Recycled Content of Steel

- 14.4% Pre-Consumer Scrap Recycled Content
- 19.8% Post-Consumer Scrap Recycled Content
- 36.9% Total Recycled Content

ASTM and AISI Code Standards

- ASTM A653/A653M, A924/A924M, A1003, C645, C754, C955, C1007
- AISI NASPEC 2007 Edition S100-07 (Supplement S2-10 for IBC 2012)
- 2012, 2015 International Building Codes and 2010, 2013 CBC

SCAFCO Technical Services

For additional information, visit www.SCAFCO.com or contact technical services at 509-343-9000 or technical@SCAFCO.com

IAPMO UNIFORM ER 0313

ICC ES ESR-3064P

SSMA

Section Properties

Table Notes:

1. The centerline bend radius is based on inside corner radii.
2. Effective properties incorporate the strength increase from the cold work of forming as applicable per AISI S100 A7.2.
3. Tabulated gross properties are based on the full-unreduced cross section of the studs away from punch-out's.
4. For deflection calculations, use the effective moment of inertia.
5. Allowable moment is the lesser of Mal and Mad. Stud distortional buckling is based on an assumed Kϕ = 0.

Section	Gross Properties							Effective and Distortional Properties						Torsional Properties						Lu (in)
	Area (in^2)	Weight (lb/ft)	Ix (in^4)	Sx (in^3)	Rx (in)	Iy (in^4)	Ry (in)	Ixe (in^4)	Sxe (in^3)	Mal (in-k)	Mad (in-k)	Vag (lb)	VaNet (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	m (in)	Ro (in)	ß	
362S137-33	0.236	0.80	0.479	0.264	1.424	0.059	0.501	0.479	0.232	4.59	4.73	1024	521	0.094	0.165	-1.003	0.615	1.813	0.694	34.7

Limiting Wall Heights

Table Notes:

1. Listed wind pressures represent calculated designed wind pressure (1.0 W based on 2009 or 0.6 W based on 2012 IBC). For deflection calculations, listed wind pressures have been reduced by 0.70 as allowed by IBC. The 5 psf pressure has not been reduced for deflection checks.
2. Studs must be braced against rotation and lateral movement at all supports.
3. Studs are assumed to be adequately braced at a maximum spacing of Lu to develop full allowable moment.
4. Web crippling check is based on 1" of bearing at end supports and 3" of bearing at interior support.
5. Shear and web crippling capacity at end supports have not been reduced for punch-out's. Shear and web crippling capacity at interior support have been reduced for the presence of punch-out adjacent to the support.
4. Combined bending and shear check at interior support is based on unreinforced web per AISI S100 (Eq. C3.3.1-1). Shear capacity and combined bending and shear check at interior support have been reduced for the presence of punch-out's adjacent to support.

Stud Spacing (in)	Non-Composite Fully Braced (5 psf)			Non-Composite Fully Braced (15 psf)			Non-Composite Fully Braced (20 psf)		
	L/120	L/240	L/360	L/240	L/360	L/600	L/240	L/360	L/600
12" o.c.	23' 3"	18' 5"	16' 1"	14' 3"	12' 7"	10' 7"	12' 4"	11' 5"	9' 8"
16" o.c.	21' 1"	16' 9"	14' 8"	12' 4"	11' 5"	9' 8"	10' 9"	10' 5"	8' 9"
24" o.c.	17' 6"	14' 8"	12' 10"	10' 1"	10' 0"	8' 5"	8' 9" e	8' 9" e	7' 8"

"e" web stiffeners required at ends.

Product Submittal Sheet

SCAFCO Steel Stud Company

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Stockton California Manufacturing Facility
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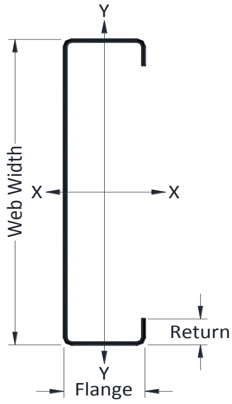
Phone: 209.670.8053 Fax: 209.670.8057

162S125-30

Product Information

The non-structural stud is fabricated from prime mill certified steel with a true galvanized coating. Heavier coatings may be available upon request.



Steel Material Properties

30 Mil	Labeled Thickness
0.0312"	Design Thickness
0.0296"	Minimum Thickness
33 ksi	Yield Strength (Fy)
45 ksi	Tensile Strength (Fu)
G40	Galvanize Coating Thickness
Red	Color Code (Painted Ends)

Geometric Properties

1-5/8"	Web Width
1-1/4"	Flange Height
3/16"	Return Length

LEED - Contributing Credits

All SCAFCO materials have a high inherent recycled steel content.

- LEED 2009 - MRc2 (2 points) & MRc4 (2 points)
- LEED v4 - MR Credits - EPD (2 points) - Waste Management (2 points) - Sourcing of Raw Materials (1 point) - Material Ingredients (1 point) - Innovation (2 points)

Recycled Content of Steel

- 14.4% Pre-Consumer Scrap Recycled Content
- 19.8% Post-Consumer Scrap Recycled Content
- 36.9% Total Recycled Content

ASTM and AISI Code Standards

- ASTM A653/A653M, A924/A924M, A1003, C645, C754
- AISI S100-07 with supplement S2-10 per 2012 IBC, AISI S100-12 per 2015 IBC
- 2012, 2015 International Building Codes and 2010, 2013 CBC

SCAFCO Technical Services

For additional information, visit www.SCAFCO.com or contact technical services at 509-343-9000 or technical@SCAFCO.com

IAPMO UNIFORM ER 0313

ICC ES ESR-3064P

SSMA

Section Properties

Table Notes:

1. The centerline bend radius is based on inside corner radii.
2. Effective properties incorporate the strength increase from the cold work of forming as applicable per AISI S100 A7.2.
3. Tabulated gross properties are based on the full-unreduced cross section of the studs away from punch-out's.
4. For deflection calculations, use the effective moment of inertia.
5. Allowable moment is the lesser of Mal and Mad. Stud distortional buckling is based on an assumed Kϕ = 0.

Section	Gross Properties							Effective and Distortional Properties						Torsional Properties						Lu (in)
	Area (in^2)	Weight (lb/ft)	Ix (in^4)	Sx (in^3)	Rx (in)	Iy (in^4)	Ry (in)	Ixe (in^4)	Sxe (in^3)	Mal (in-k)	Mad (in-k)	Vag (lb)	VaNet (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	m (in)	Ro (in)	ß	
162S125-30	0.131	0.45	0.061	0.075	0.681	0.026	0.441	0.060	0.060	1.19	1.29	543	106	0.043	0.014	-1.014	0.585	1.298	0.390	29.2

Limiting Wall Heights

Table Notes:

1. Allowable composite limiting heights are calculated using ICC-ES AC86-2012.
2. No fasteners are required for attaching the stud to the track.
3. Stud end bearing must be a minimum of 1 inch.
4. Composite limiting heights are based on a single layer of 5/8" type-X gypsum board installed in the vertical orientation to both sides of the wall over full height using minimum No. 6 type S drywall screws spaced a maximum of 12" oc for studs at 24" spacing, and 16" oc for studs at 16" and 12" spacing.

Table Notes:

1. Loads have not been reduced for strength or deflection checks; full lateral load is applied.
2. Limiting heights are based on steel properties only without the contribution of sheathing to strength and stiffness of the assembly. Properly fastened sheathing is still required for members to be considered fully braced.
3. Web crippling check based on 1" end bearing.
4. Studs are assumed to be adequately braced at maximum spacing of Lu to develop full allowable moment.

Table Notes:

1. Loads have not been reduced for strength or deflection checks; full lateral load is applied.
2. Limiting heights are based on studs braced at maximum spacing of 48" oc. Bracing can be placed at greater distances if deflection controls.
3. Web crippling check based on 1" end bearing.

Stud Spacing (in)	Composite Wall Heights (5 psf)			Non-Composite Fully Braced (5 psf)			Non-Composite Braced at 48" O.C. (5 psf)		
	L/120	L/240	L/360	L/120	L/240	L/360	L/120	L/240	L/360
12" o.c.	14' 11"	11' 10"	10' 4"	11' 8"	9' 3"	8' 1"	11' 8"	9' 3"	8' 1"
16" o.c.	13' 7"	10' 9"	9' 4"	10' 7"	8' 5"	-	10' 3"	8' 5"	-
24" o.c.	11' 10"	9' 4"	-	8' 11"	-	-	8' 4"	-	-

Product Submittal Sheet

SCAFCO Steel Stud Company

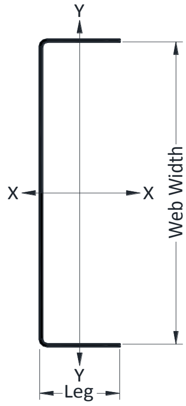
Spokane Washington Manufacturing Facility
2800 East Main Avenue, Spokane, WA 99202
Phone: 509.343.9000 Fax: 509-343-9060

Stockton California Manufacturing Facility
2525 South Airport Way, Stockton, CA 95206
Phone: 209.670.8053 Fax: 209.670.8057

362T150-33

Product Information

The framing track is fabricated from prime mill certified steel with a true galvanized coating.
Heavier coatings may be available upon request.



Steel Material Properties

33 Mil	Labeled Thickness
0.0346"	Design Thickness
0.0329"	Minimum Thickness
33 ksi	Yield Strength (Fy)
45 ksi	Tensile Strength (Fu)
G60	Galvanize Coating Thickness
White	Color Code (Painted Ends)

Geometric Properties

3-5/8"	Web Width
1-1/2"	Leg Height

LEED - Contributing Credits

All SCAFCO materials have a high inherent recycled steel content.

- LEED 2009 - MRc2 (2 points) & MRc4 (2 points)
- LEED v4 - MR Credits - EPD (2 points) - Waste Management (2 points) - Sourcing of Raw Materials (1 point) - Material Ingredients (1 point) - Innovation (2 points)

Recycled Content of Steel

- 14.4% Pre-Consumer Scrap Recycled Content
- 19.8% Post-Consumer Scrap Recycled Content
- 36.9% Total Recycled Content

ASTM and AISI Code Standards

- ASTM A653/A653M, A924/A924M, A1003, C645, C754, C955, C1007
- AISI S100-07 with supplement S2-10 per 2012 IBC, AISI S100-12 per 2015 IBC
- 2012, 2015 International Building Codes and 2010, 2013 CBC

SCAFCO Technical Services

For additional information, visit www.SCAFCO.com or contact technical services at 509-343-9000 or technical@SCAFCO.com

Section Properties

IAPMO UNIFORM ER 0313 | ICC ES ESR-3064P | SSMA

Table Notes:

1. The centerline bend radius is based on inside corner radii.
2. Web depth for track section is equal to the nominal height plus 2 times the design thickness plus the bend radius
3. Hems on nonstructural track sections are ignored. Not all track members are hemmed.
4. Effective properties incorporate the strength increase from the cold work of forming as applicable per AISI S100 Section A7.2.
5. For deflection calculations, use the effective moment of inertia.
6. Based on ASTM C645, the 18 Mil and 30 Mil track material is considered nonstructural.

Section	Gross Properties							Effective Properties				Torsional Properties					
	Area (in^2)	Weight (lb/ft)	Ix (in^4)	Sx (in^3)	Rx (in)	Iy (in^4)	Ry (in)	Ixe (in^4)	Sxe (in^3)	Ma (in-k)	Vag (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	m (in)	Ro (in)	ß
362T150-33	0.229	0.78	0.499	0.264	1.475	0.050	0.467	0.414	0.180	3.56	1024	0.091	0.124	-0.854	0.522	1.767	0.766

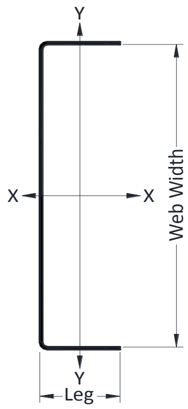
Product Submittal Sheet

SCAFCO Steel Stud Company

Spokane Washington Manufacturing Facility
2800 East Main Avenue, Spokane, WA 99202
Phone: 509.343.9000 Fax: 509-343-9060

Stockton California Manufacturing Facility
2525 South Airport Way, Stockton, CA 95206
Phone: 209.670.8053 Fax: 209.670.8057

162T125-30



Product Information

The framing track is fabricated from prime mill certified steel with a true galvanized coating.
Heavier coatings may be available upon request.

Steel Material Properties

30 Mil	Labeled Thickness
0.0312"	Design Thickness
0.0296"	Minimum Thickness
33 ksi	Yield Strength (Fy)
45 ksi	Tensile Strength (Fu)
G40	Galvanize Coating Thickness
Red	Color Code (Painted Ends)

Geometric Properties

1-5/8"	Web Width
1-1/4"	Leg Height

LEED - Contributing Credits

All SCAFCO materials have a high inherent recycled steel content.

- LEED 2009 - MRc2 (2 points) & MRc4 (2 points)
- LEED v4 - MR Credits - EPD (2 points) - Waste Management (2 points) - Sourcing of Raw Materials (1 point) - Material Ingredients (1 point) - Innovation (2 points)

Recycled Content of Steel

- 14.4% Pre-Consumer Scrap Recycled Content
- 19.8% Post-Consumer Scrap Recycled Content
- 36.9% Total Recycled Content

ASTM and AISI Code Standards

- ASTM A653/A653M, A924/A924M, A1003, C645, C754, C955, C1007
- AISI S100-07 with supplement S2-10 per 2012 IBC, AISI S100-12 per 2015 IBC
- 2012, 2015 International Building Codes and 2010, 2013 CBC

SCAFCO Technical Services

For additional information, visit www.SCAFCO.com or contact technical services at 509-343-9000 or technical@SCAFCO.com

IAPMO UNIFORM ER 0313

ICC ES ESR-3064P

SSMA

Section Properties

Table Notes:

1. The centerline bend radius is based on inside corner radii.
2. Web depth for track section is equal to the nominal height plus 2 times the design thickness plus the bend radius
3. Hems on nonstructural track sections are ignored. Not all track members are hemmed.
4. Effective properties incorporate the strength increase from the cold work of forming as applicable per AISI S100 Section A7.2.
5. For deflection calculations, use the effective moment of inertia.
6. Based on ASTM C645, the 18 Mil and 30 Mil track material is considered nonstructural.

Section	Gross Properties							Effective Properties				Torsional Properties					
	Area (in^2)	Weight (lb/ft)	Ix (in^4)	Sx (in^3)	Rx (in)	Iy (in^4)	Ry (in)	Ixe (in^4)	Sxe (in^3)	Ma (in-k)	Vag (lb)	Jx1000 (in^4)	Cw (in^6)	Xo (in)	m (in)	Ro (in)	ß
162T125-30	0.129	0.44	0.070	0.079	0.735	0.022	0.409	0.057	0.050	1.00	597	0.042	0.012	-0.870	0.500	1.210	0.483

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Stockton California Manufacturing Facility
2525 South Airport Way, Stockton, CA 95206
Phone: 209.670.8053 Fax: 209.670.8057

150U050-54

Product Information

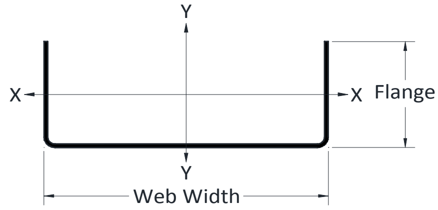
The u-channel or cold rolled channel (CRC) is often used as bracing through the punch out of the studs.
The CRC can also be used for ceiling spans and soffit framing.

Steel Material Properties

54 Mil	Labeled Thickness
0.0566"	Design Thickness
0.05338"	Minimum Thickness
50 ksi	Yield Strength (Fy)
65 ksi	Tensile Strength (Fu)
G60	Galvanize Coating Thickness

Geometric Properties

1-1/2"	Web Width
1/2"	Flange Height



LEED - Contributing Credits

All SCAFCO materials have a high inherent recycled steel content.

- LEED 2009 - MRc2 (2 points) & MRc4 (2 points)
- LEED v4 - MR Credits - EPD (2 points) - Waste Management (2 points) - Sourcing of Raw Materials (1 point) - Material Ingredients (1 point) - Innovation (2 points)

Recycled Content of Steel

- 14.4% Pre-Consumer Scrap Recycled Content
- 19.8% Post-Consumer Scrap Recycled Content
- 34.2% Total Recycled Content

ASTM and AISI Code Standards

- ASTM A653/A653M, A924/A924M, A1003, C645, C754, C955, C1007
- AISI NASPEC 2007 Edition S100-07 (Supplement S2-10 for IBC 2012)
- 2012, 2015 International Building Codes and 2013, 2016 CBC

SCAFCO Technical Services

For additional information, visit www.SCAFCO.com or contact technical services at 509-343-9000 or technical@SCAFCO.com

Section Properties

Table Notes:

1. Inside bend radius taken as 3/32"

Section	Gross Properties					Effective and Distortional Properties				
	Area (in^2)	Weight (lb/ft)	Ix (in^4)	Rx (in)	Iy (in^4)	Ry (in)	Ixe (in^4)	Sxe (in^3)	Mal (in-k)	Vag (lb)
150U050-54	0.129	0.44	0.039	0.547	0.003	0.144	0.039	0.052	1.81	1273

Limiting Wall Heights

Table Notes:

1. Multiple span indicates two or more equal spans with channel continuous over interior supports.
2. Listed spans are based on unbraced compression flanges.
3. Web crippling check is based on ¾" bearing at end and interior supports. No bearing stiffeners are required.

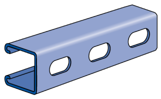
Allowable Ceiling Spans (U-Sections) - L/240

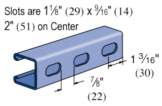
	4 psf Channel Spacing (in) on center					6 psf Channel Spacing (in) on center					13 psf Channel Spacing (in) on center					15 psf Channel Spacing (in) on center				
	24	36	48	60	72	24	36	48	60	72	24	36	48	60	72	24	36	48	60	72
Single	5' 6"	4' 10"	4' 5"	4' 1"	3' 10"	4' 10"	4' 3"	3' 10"	3' 7"	3' 5"	3' 9"	3' 4"	3' 0"	2' 10"	2' 8"	3' 7"	3' 2"	2' 11"	2' 8"	2' 6"
Multiple	7' 1"	6' 2"	5' 8"	5' 3"	4' 11"	6' 2"	5' 5"	4' 11"	4' 7"	4' 4"	4' 10"	4' 3"	3' 10"	3' 7"	3' 4"	4' 7"	4' 0"	3' 8"	3' 5"	3' 2"

Allowable Ceiling Spans (U-Sections) - L/360

	4 psf Channel Spacing (in) on center					6 psf Channel Spacing (in) on center					13 psf Channel Spacing (in) on center					15 psf Channel Spacing (in) on center				
	24	36	48	60	72	24	36	48	60	72	24	36	48	60	72	24	36	48	60	72
Single	5' 6"	4' 10"	4' 5"	4' 1"	3' 10"	4' 10"	4' 3"	3' 10"	3' 7"	3' 5"	3' 9"	3' 4"	3' 0"	2' 10"	2' 8"	3' 7"	3' 2"	2' 11"	2' 8"	2' 6"
Multiple	7' 1"	6' 2"	5' 8"	5' 3"	4' 11"	6' 2"	5' 5"	4' 11"	4' 7"	4' 4"	4' 10"	4' 3"	3' 10"	3' 7"	3' 4"	4' 7"	4' 0"	3' 8"	3' 5"	3' 2"

UNISTRUT® P1000T





Materials & Finishes - Standard:

- **Pregalvanized (PG):** Conforms to ASTM A653 SS GR 33, G90.
- **Unistrut Defender (DF):** Conforms to ASTM A1046 SS GR 33
- **Hot Dip Galvanized (HG):** Steel conforms to ASTM A1011 SS GR 33, Finish conforms to ASTM A123
- **Perma-Green (GR):** Steel conforms to ASTM A1011 SS GR 33, E-Coat finish
- **Perma-Gold (ZD):** Steel conforms to ASTM A1011 SS GR 33, Finish conforms to ASTM B633, Type II SC3
- **Plain (PL):** Conforms to ASTM A1011 SS GR 33

Materials & Finishes - Special Metals:

- **Stainless Steel, Type 304 (SS):** ASTM A240, Type 304 *
- **Stainless Steel, Type 316 (ST):** ASTM A240, Type 316 *
- **Aluminum (EA):** ASTM B221, Type 6063-T6 (Extruded) *

* These materials have different physical properties and performance characteristics. Please contact us for design support.

Part No.	Length (ft)	Finish	Product Weight / Ft (lbs/ft)
P1000T	10	PG	1.85
P1000T	20	PG	1.85
P1000T	10	DF	1.961
P1000T	20	DF	1.961
P1000T	20	HG	1.961
P1000T	10	HG	1.961
P1000T	20	GR	1.85
P1000T	10	GR	1.85
P1000T	10	PL	1.85
P1000T	20	PL	1.85
P1000T	10	ZD	1.85
P1000T	20	ZD	1.85
P1000T	20	SS	1.85
P1000T	10	SS	1.88
P1000T	20	ST	1.85
P1000T	10	EA	0.76
P1000T	20	EA	0.76

Beam Loading - P1000T

Span (in)	Max Allow. Uniform Load (lbs)	Deflection at Uniform load (in)	Uniform Loading at Deflection Span/180 (lbs)	Span/240 (lbs)	Span/360 (lbs)	Lateral Bracing Reduction Factor
24	1,437	0.06	1,437	1,437	1,437	1.00
36	961	0.13	961	961	765	0.94
48	723	0.22	723	646	425	0.88
60	578	0.35	553	408	272	0.82
72	476	0.50	383	289	187	0.78
84	408	0.68	281	213	136	0.75
96	357	0.89	213	162	111	0.71
108	323	1.14	170	128	85	0.69
120	289	1.40	136	102	68	0.66
144	238	2.00	94	68	51	0.61
168	204	2.72	68	51	34	0.55
192	179	3.55	51	43	NR	0.51
216	162	4.58	43	34	NR	0.47
240	145	5.62	34	NR	NR	0.44
Note	NR - Not Recommended					

Refer to the General Specifications for loading information.

Column Loading - P1000T

Unbraced Height (in)	Allowable Load at Slot Face (lbs)	Max Column Load Applied at C.G. K=0.65 (lbs)	K=0.80 (lbs)	K=1.0 (lbs)	K=1.2 (lbs)
24	3,550	10,740	9,890	8,770	7,740
36	3,190	8,910	7,740	6,390	5,310
48	2,770	7,260	6,010	4,690	3,800
60	2,380	5,910	4,690	3,630	2,960
72	2,080	4,840	3,800	2,960	2,400
84	1,860	4,040	3,200	2,480	1,980
96	1,670	3,480	2,750	2,110	1,660
108	1,510	3,050	2,400	1,810	KL/r>200
120	1,380	2,700	2,110	KL/r>200	KL/r>200
144	1,150	2,180	1,660	KL/r>200	KL/r>200

Refer to the General Specifications for loading information.

Project:

Architect / Engineer:

Date: **Phone:**

Contractor:

Address:

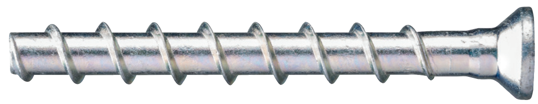
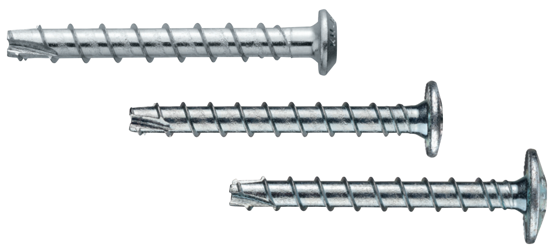
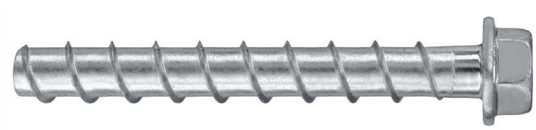
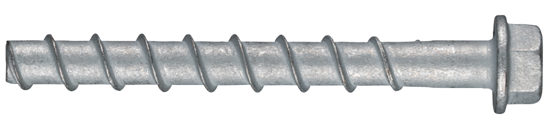
Notes:

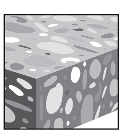
Approval Stamp:

KWIK HUS-EZ SCREW ANCHOR

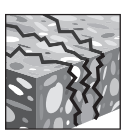
PRODUCT DESCRIPTION

KWIK HUS EZ carbon steel anchors

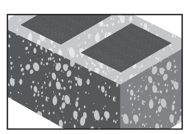
Anchor System		Features and Benefits
	Carbon Steel KH-EZ C 1/4" & 3/8"	• OSHA Table 1926.1153 Table 1 complaint installation when installed with Hilti vacuum and DRS system or Hilti SafeSet™ hollow drill bit technology • Easy installation using impact tool or torque wrench • Product and length identification marks helps facilitate quality control after installation • Through fixture installation improves productivity and more accurate installation. • Thread design helps enable quality setting and exceptional load values in wide variety of base material strengths. • 1/4" diameter available in hex head countersunk head and pan head styles. • Anchor is fully removable. • Anchor diameter is same as drill bit diameter. No special diameter bit required. • Suitable for reduced edge distances and spacing. • Corrosion resistant coating allows for use in outdoor moderate corrosive environments (KH-EZ CRC only). • Installation process allows for adjustability.
	Carbon Steel 1/4" KH-EZ P, PM, PL	
	Carbon Steel KH EZ 1/4"-3/4"	
	Carbon Steel KH-EZ CRC 3/8"-3/4"	



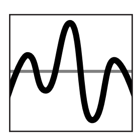
Uncracked concrete



Cracked concrete



Grout-filled concrete masonry



Seismic Design Categories A-F

SAFESET

SafeSet™ System with Hollow Drill Bit

Profis Anchor design software

Approvals/Listings	
ICC-ES (International Code Council)	ESR-3027 in concrete per ACI 318-14 Ch. 17 / ACI 355.2/ ICC-ES AC193 ESR-3056 in grout-filled CMU per ICC-ES AC106
City of Los Angeles	City of Los Angeles 2017 LABC Supplement (within ESR-3027 and ESR-3056)
Florida Building Code	2017 FBC w/ HVHZ (within ESR-3027 and ESR-3056)
FM (Factory Mutual)	Pipe hanger components for automatic sprinkler systems for KH-EZ I and KH-EZ E

ICC ES LA DBS DEPARTMENT OF BUILDING AND SAFETY

MATERIAL SPECIFICATIONS

Heat treated carbon steel with a minimum zinc coating of 0.0003 inch (8 µm) thick in accordance with DIN EN ISO 4042.
KH-EZ CRC has mechanically deposited zinc coating with a minimum thickness of 0.0021 inch (53 µm) in accordance with ASTM B695, Class 55.

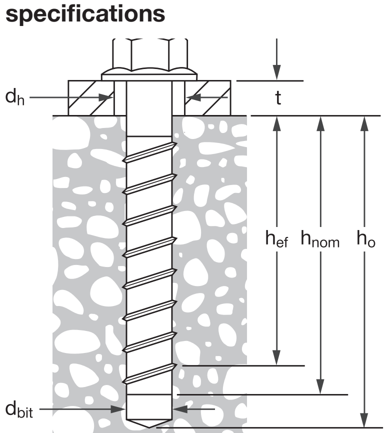
INSTALLATION PARAMETERS

Table 1 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC specifications

Setting information	Symbol	Units	Nominal anchor diameter													
			1/4		3/8				1/2			5/8			3/4	
Head style and coating			Hex, P, PM, PL, C head		Hex, C head		Hex, C head (Including CRC)		Hex head (Including CRC)			Hex head (Including CRC)			Hex head (Including CRC)	
Nominal bit diameter	d_{bit}	in.	1/4		3/8				1/2			5/8			3/4	
Minimum nominal embedment	h_{nom}	in.	1-5/8	2-1/2	1-5/8	2-1/8	2-1/2	3-1/4	2-1/4	3	4-1/4	3-1/4	4	5	4	6-1/4
Minimum effective embedment	h_{ef}	in.	1.18	1.92	1.11	1.54	1.86	2.50	1.50	2.16	3.22	2.39	3.03	3.88	2.92	4.84
Minimum hole depth	h_o	in.	2	2-7/8	1-7/8	2-3/8	2-3/4	3-1/2	2-5/8	3-3/8	4-5/8	3-5/8	4-3/8	5-3/8	4-3/8	6-5/8
Minimum fixture hole diameter	d_h	in.	3/8		1/2				5/8			3/4			7/8	
Anchor Length = h_{nom} + t	ℓ		See ordering information													
Installation torque concrete[1]	T_{inst}	ft-lb (Nm)	18 (24)		19 (26)	40 (54)			45 (61)			85 (115)			95[4] (129)	
Maximum impact wrench torque rating concrete[2]	$T_{impact,max}$	ft-lb (Nm)	157 (213)		157 (213)	450 (610)			137 (186)	450 (610)		590 (800)			590 (800)	
Installation torque masonry KH-EZ (P, PM, PL, C)	T_{inst}	ft-lb (Nm)	21 (28)		22 (30)				34 (46)			38 (52)			70 (95)	
Installation torque masonry for KH-EZ CRC	T_{inst}	ft-lb (Nm)					20 (27)		25 (34)			35 (48)			45 (61)	
Maximum impact wrench torque rating masonry for KH-EZ (P, PM, PL, C)[2,3]	$T_{impact,max}$	ft-lb (Nm)	114 (155)		114 (155)			332 (450)	332 (450)			332 (450)			332 (450)	
Maximum impact wrench torque rating masonry for KH-EZ CRC[2,3]	$T_{impact,max}$	ft-lb (Nm)					100 (136)		100 (136)			332 (450)			332 (450)	
Wrench size		in.	7/16		9/16				3/4			15/16			1-1/8	

1 T_{inst} is the maximum installation torque that may be applied with a torque wrench.
2 Because of variability in measurement procedures, the published torque of an impact tool may not correlate properly with the above setting torques. Over torquing can damage the anchor and/or reduce its holding capacity.
3 For more information on KWIK HUS-EZ installed in masonry, see ESR-3056 and Design Information for Masonry in this section.
4 Maximum installation torque in concrete for 3/4-in diameter KH-EZ CRC is 85 ft-lbs. (115 Nm).

Figure 1 - Hilti KWIK HUS-EZ specifications



DESIGN INFORMATION IN CONCRETE PER ACI 318

ACI 318-14 Chapter 17 design

The load values contained in this section are Hilti Simplified Design Tables. The load tables in this section were developed using the Strength Design parameters and variables of ESR-3027 and the equations within ACI 318-14 Chapter 17. For a detailed explanation of the Hilti Simplified Design Tables, refer to section 3.1.8 of the North American Product Technical Guide, Volume 2: Anchor Fastening Technical Guide, Edition 19 (PTG Ed. 19). Data tables from ESR-3027 are not contained in this section, but can be found at www.icc-es.org or at www.hilti.com.

Table 2 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC design Strength with concrete / pullout failure in uncracked concrete[1,2,3,4]

Nominal anchor diameter in. (mm)	Nominal Embed. Depth in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
		f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)
1/4 (6.4)	1-5/8 (41)	585 (2.6)	620 (2.8)	675 (3.0)	765 (3.4)	1,075 (4.8)	1,180 (5.2)	1,360 (6.0)	1,670 (7.4)
	2-1/2 (64)	1,525 (6.8)	1,670 (7.4)	1,930 (8.6)	2,365 (10.5)	2,235 (9.9)	2,450 (10.9)	2,825 (12.6)	3,460 (15.4)
3/8 (9.5)	1-5/8 (41)	910 (4.0)	1,000 (4.4)	1,155 (5.1)	1,415 (6.3)	980 (4.4)	1,075 (4.8)	1,245 (5.5)	1,520 (6.8)
	2-1/8 (54)	1,490 (6.6)	1,635 (7.3)	1,885 (8.4)	2,310 (10.3)	1,605 (7.1)	1,760 (7.8)	2,030 (9.0)	2,485 (11.1)
	2-1/2 (64)	1,980 (8.8)	2,165 (9.6)	2,505 (11.1)	3,065 (13.6)	2,130 (9.5)	2,335 (10.4)	2,695 (12.0)	3,300 (14.7)
	3-1/4 (83)	3,085 (13.7)	3,375 (15.0)	3,900 (17.3)	4,775 (21.2)	6,640 (29.5)	7,275 (32.4)	8,400 (37.4)	10,290 (45.8)
1/2 (12.7)	2-1/4 (57)	1,645 (7.3)	1,800 (8.0)	2,080 (9.3)	2,550 (11.3)	1,770 (7.9)	1,940 (8.6)	2,240 (10.0)	2,745 (12.2)
	3 (76)	2,785 (12.4)	3,050 (13.6)	3,525 (15.7)	4,315 (19.2)	3,000 (13.3)	3,285 (14.6)	3,795 (16.9)	4,645 (20.7)
	4-1/4 (108)	5,070 (22.6)	5,555 (24.7)	6,415 (28.5)	7,855 (34.9)	10,920 (48.6)	11,965 (53.2)	13,815 (61.5)	16,920 (75.3)
5/8 (15.9)	3-1/4 (83)	3,240 (14.4)	3,550 (15.8)	4,100 (18.2)	5,025 (22.4)	3,490 (15.5)	3,825 (17.0)	4,415 (19.6)	5,410 (24.1)
	4 (102)	4,630 (20.6)	5,070 (22.6)	5,855 (26.0)	7,170 (31.9)	9,970 (44.3)	10,920 (48.6)	12,610 (56.1)	15,445 (68.7)
	5 (127)	6,705 (29.8)	7,345 (32.7)	8,485 (37.7)	10,390 (46.2)	14,445 (64.3)	15,825 (70.4)	18,270 (81.3)	22,380 (99.6)
3/4 (19.1)	4 (102)	4,380 (19.5)	4,795 (21.3)	5,540 (24.6)	6,785 (30.2)	9,430 (41.9)	10,330 (45.9)	11,930 (53.1)	14,610 (65.0)
	6-1/4 (159)	9,345 (41.6)	10,235 (45.5)	11,820 (52.6)	14,475 (64.4)	20,125 (89.5)	22,045 (98.1)	25,455 (113.2)	31,175 (138.7)

Table 3 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC design Strength with concrete / pullout failure in cracked concrete[1,2,3,4,5]

Nominal anchor diameter in. (mm)	Nominal embed. in. (mm)	Tension - ϕN_n				Shear - ϕV_n			
		f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)	f'_c = 2,500 psi (17.2 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 6,000 psi (41.4 MPa) lb (kN)
1/4 (6.4)	1-5/8 (41)	300 (1.3)	315 (1.4)	345 (1.5)	390 (1.7)	765 (3.4)	835 (3.7)	965 (4.3)	1,180 (5.2)
	2-1/2 (64)	760 (3.4)	830 (3.7)	960 (4.3)	1,175 (5.2)	1,585 (7.1)	1,735 (7.7)	2,000 (8.9)	2,450 (10.9)
3/8 (9.5)	1-5/8 (41)	475 (2.1)	520 (2.3)	600 (2.7)	730 (3.2)	695 (3.1)	760 (3.4)	880 (3.9)	1,080 (4.8)
	2-1/8 (54)	1,055 (4.7)	1,155 (5.1)	1,335 (5.9)	1,635 (7.3)	1,135 (5.0)	1,245 (5.5)	1,440 (6.4)	1,760 (7.8)
	2-1/2 (64)	1,400 (6.2)	1,535 (6.8)	1,775 (7.9)	2,170 (9.7)	1,510 (6.7)	1,655 (7.4)	1,910 (8.5)	2,340 (10.4)
	3-1/4 (83)	2,185 (9.7)	2,390 (10.6)	2,765 (12.3)	3,385 (15.1)	4,705 (20.9)	5,155 (22.9)	5,950 (26.5)	7,285 (32.4)
1/2 (12.7)	2-1/4 (57)	1,035 (4.6)	1,135 (5.0)	1,310 (5.8)	1,605 (7.1)	1,115 (5.0)	1,220 (5.4)	1,410 (6.3)	1,725 (7.7)
	3 (76)	1,755 (7.8)	1,920 (8.5)	2,220 (9.9)	2,715 (12.1)	1,890 (8.4)	2,070 (9.2)	2,390 (10.6)	2,925 (13.0)
	4-1/4 (108)	3,190 (14.2)	3,495 (15.5)	4,040 (18.0)	4,945 (22.0)	6,875 (30.6)	7,530 (33.5)	8,695 (38.7)	10,650 (47.4)
5/8 (15.9)	3-1/4 (83)	2,040 (9.1)	2,235 (9.9)	2,580 (11.5)	3,165 (14.1)	2,200 (9.8)	2,410 (10.7)	2,780 (12.4)	3,405 (15.1)
	4 (102)	3,140 (14.0)	3,510 (15.6)	3,845 (17.1)	4,515 (20.1)	6,760 (30.1)	7,560 (33.6)	8,280 (36.8)	9,725 (43.3)
	5 (127)	4,225 (18.8)	4,625 (20.6)	5,340 (23.8)	6,540 (29.1)	9,095 (40.5)	9,965 (44.3)	11,505 (51.2)	14,090 (62.7)
3/4 (19.1)	4 (102)	2,755 (12.3)	3,020 (13.4)	3,485 (15.5)	4,270 (19.0)	5,940 (26.4)	6,505 (28.9)	7,510 (33.4)	9,200 (40.9)
	6-1/4 (159)	5,885 (26.2)	6,445 (28.7)	7,440 (33.1)	9,115 (40.5)	12,670 (56.4)	13,880 (61.7)	16,030 (71.3)	19,630 (87.3)

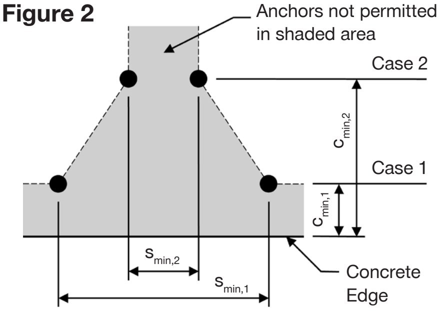
1 See PTG Ed. 19 Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in Tables 6 through 15 as necessary. Compare to the steel values in Table 4. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λa as follows: For sand-lightweight, λa = 0.68. For all-lightweight, λa = 0.60.
5 Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:
1/4-in diameter by 1-5/8-in nominal embedment depth - $a_{N,seis}$ = 0.60
All other sizes - $a_{N,seis}$ = 0.75
No reduction needed for seismic shear. See PTG Ed. 19 Section 3.1.8 for additional information on seismic applications.

Table 4 - Steel design strength for Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC anchors[1,2]

Anchor diameter in. (mm)	Nominal embedment depth in. (mm)			Tensile [3] ϕN_{sa} lb (kN)	Shear [4] ϕV_{sa} lb (kN)	Seismic shear [5] $\phi V_{sa,eq}$ lb (kN)
1/4 (6.4)	1-5/8 (41)	2-1/2 (64)		3,945 (17.5)	930 (4.1)	835 (3.7)
3/8 (9.5)	1-5/8 (41)	2-1/8 (54)		5,980 (26.6)	2,200 (9.8)	2,200 (9.8)
	2-1/2 (64)	3-1/4 (83)		6,720 (29.9)	3,110 (13.8)	1,865 (8.3)
1/2 (12.7)	2-1/4 (57)	3 (76)	4-1/4 (108)	11,780 (52.4)	5,545 (24.7)	3,330 (14.8)
5/8 (15.9)	3-1/4 (83)	4 (102)	5 (127)	15,735 (70.0)	6,735 (30.0)	4,040 (18.0)
3/4 (19.1)	4 (102)	6-1/4 (159)		20,810 (92.6)	9,995 (44.5)	6,935 (30.8)

1 See PTG Ed. 19 Section 3.1.8 to convert design strength value to ASD value.
2 Hilti KWIK HUS-EZ anchors are to be considered brittle steel elements.
3 Tensile $\phi N_{sa} = \phi A_{se,N} f_{uta}$ as noted in ACI 318 Chapter 17.
4 Shear values determined by static shear tests with $\phi V_{sa} < \phi\ 0.60 A_{se,V} f_{uta}$ as noted in ACI 318 Chapter 17.
5 Seismic shear values determined by seismic shear tests with $\phi V_{sa} \leq \phi\ 0.60 A_{se,V} f_{uta}$ as noted in ACI 318 Chapter 17. See PTG Ed. 19 Section 3.1.8 for additional information on seismic applications.

Figure 2



For a specific edge distance, the permitted spacing is calculated as follows:

$$s \geq s_{min,2} + \frac{(s_{min,1} - s_{min,2})}{(c_{min,1} - c_{min,2})}(c - c_{min,2})$$

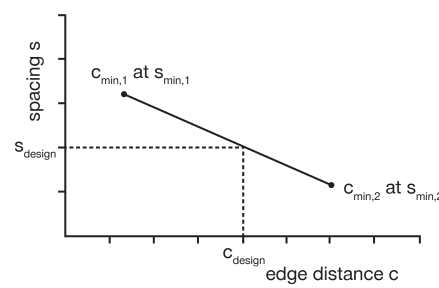


Table 5 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC specifications[1]

Setting information		Symbol	Units	Nominal anchor diameter													
				1/4		3/8				1/2			5/8			3/4	
Effective minimum embedment		h_{ef}	in.	1.18	1.92	1.11	1.54	1.86	2.50	1.50	2.16	3.22	2.39	3.03	3.88	2.92	4.84
Minimum member thickness		h_{min}	in.	3-1/4	4-1/8	3-1/4	3-2/3	4	4-7/8	4-1/2	4-3/4	6-3/4	5	6	7	6	8-1/8
Case 1		$c_{min,1}$	in.	1.50						1.75							
		for $s_{min,1} \geq$	in.	3									4				
Case 2		$c_{min,2}$	in.	2	2.78	2.63	2.75	2.92	3.75	2.75	3.75	5.25	3.63	4.57	5.81	4.41	7.28
		for $s_{min,2} \geq$	in.	1.50		2.25				3							

1 Linear interpolation is permitted to establish an edge distance and spacing combination between Case 1 and Case 2. Linear interpolation for a specific edge distance c, where $c_{min,1} < c < c_{min,2}$ will determine the permissible spacings.

Table 8 - Load Adjustment Factors for 3/8-in. diameter Hilti KH-EZ, KH-EZ C and KH-EZ CRC in uncracked [1,2]

3/8-in. KH-EZ uncracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[3] f_{AV}				Edge distance in shear: ⊥ toward edge f_{RV}				Edge distance in shear: II to and away from edge f_{RV}				Conc. thickness factor in shear[4] f_{HV}			
Embedment h_{nom}	in.	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	(mm)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)
1-1/2	(38)	n/a	n/a	n/a	n/a	0.58	0.62	0.63	0.57	n/a	n/a	n/a	n/a	0.49	0.32	0.25	0.08	0.58	0.62	0.50	0.17	n/a	n/a	n/a	n/a
2	(51)	n/a	n/a	n/a	n/a	0.76	0.75	0.75	0.66	n/a	n/a	n/a	n/a	0.75	0.49	0.38	0.13	0.76	0.75	0.75	0.26	n/a	n/a	n/a	n/a
2-1/4	(57)	0.84	0.74	0.70	0.65	0.86	0.82	0.81	0.70	0.65	0.62	0.60	0.55	0.90	0.59	0.46	0.16	0.90	0.82	0.81	0.31	n/a	n/a	n/a	n/a
2-1/2	(64)	0.88	0.77	0.72	0.67	0.95	0.91	0.88	0.75	0.67	0.63	0.61	0.55	1.00	0.69	0.54	0.18	1.00	0.91	0.88	0.37	n/a	n/a	n/a	n/a
3	(76)	0.95	0.82	0.77	0.70	1.00	1.00	1.00	0.85	0.71	0.66	0.63	0.56		0.90	0.71	0.24		1.00	1.00	0.48	n/a	n/a	n/a	n/a
3-1/4	(83)	0.99	0.85	0.79	0.72				0.90	0.72	0.67	0.64	0.57		1.00	0.80	0.27				0.54	0.95	n/a	n/a	n/a
3-1/2	(89)	1.00	0.88	0.81	0.73				0.95	0.74	0.68	0.65	0.58			0.89	0.30				0.61	0.98	n/a	n/a	n/a
4	(102)		0.93	0.86	0.77				1.00	0.78	0.71	0.68	0.59			1.00	0.37				0.74	1.00	0.91	0.84	n/a
4-1/2	(114)		0.99	0.90	0.80					0.81	0.73	0.70	0.60				0.44				0.88			0.89	n/a
4-3/4	(121)		1.00	0.93	0.82					0.83	0.75	0.71	0.60				0.48				0.96			0.91	0.639
5	(127)			0.95	0.83					0.84	0.76	0.72	0.61				0.52				1.00			0.94	0.655
6	(152)			1.00	0.90					0.91	0.81	0.76	0.63				0.68							1.00	0.718
7	(178)				0.97					0.98	0.86	0.81	0.65				0.86								0.775
8	(203)				1.00					1.00	0.91	0.85	0.67				1.00								0.829
9	(229)										0.97	0.90	0.69												0.879
10	(254)										1.00	0.94	0.71												0.927
11	(279)											0.98	0.74												0.972
12	(305)											1.00	0.76												1.000
14	(356)												0.80												
16	(406)												0.84												
18	(457)												0.89												
20	(508)												0.93												
24	(610)												1.000												

Table 9 - Load Adjustment Factors for 3/8-in. diameter Hilti KH-EZ, KH-EZ C and KH-EZ CRC in cracked [1,2]

3/8-in. KH-EZ cracked concrete		Spacing factor in tension f_{AN}				Edge distance factor in tension f_{RN}				Spacing factor in shear[3] f_{AV}				Edge distance in shear: ⊥ toward edge f_{RV}				Edge distance in shear: II to and away from edge f_{RV}				Conc. thickness factor in shear[4] f_{HV}			
Embedment h_{nom}	in.	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4	1-5/8	2-1/8	2-1/2	3-1/4
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	(mm)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)	(41)	(54)	(64)	(83)
1-1/2	(38)	n/a	n/a	n/a	n/a	0.92	0.74	0.66	0.57	n/a	n/a	n/a	n/a	0.49	0.32	0.25	0.09	0.92	0.64	0.50	0.17	n/a	n/a	n/a	n/a
2	(51)	n/a	n/a	n/a	n/a	1.00	0.90	0.79	0.66	n/a	n/a	n/a	n/a	0.76	0.50	0.39	0.13	1.00	0.90	0.77	0.26	n/a	n/a	n/a	n/a
2-1/4	(57)	0.84	0.74	0.70	0.65	1.00	0.98	0.85	0.70	0.66	0.62	0.60	0.55	0.90	0.59	0.46	0.16	1.00	0.98	0.85	0.31	n/a	n/a	n/a	n/a
2-1/2	(64)	0.88	0.77	0.72	0.67	1.00	1.00	0.92	0.75	0.67	0.63	0.61	0.55	1.00	0.69	0.54	0.18	1.00	1.00	0.92	0.37	n/a	n/a	n/a	n/a
3	(76)	0.95	0.82	0.77	0.70	1.00		1.00	0.85	0.71	0.66	0.63	0.56	1.00	0.91	0.71	0.24	1.00	1.00	1.00	0.48	n/a	n/a	n/a	n/a
3-1/4	(83)	0.99	0.85	0.79	0.72				0.90	0.73	0.67	0.64	0.57		1.00	0.80	0.27				0.55	0.95	n/a	n/a	n/a
3-1/2	(89)	1.00	0.88	0.81	0.73				0.95	0.74	0.68	0.65	0.58			0.90	0.31				0.61	0.98	n/a	n/a	n/a
4	(102)		0.93	0.86	0.77				1.00	0.78	0.71	0.68	0.59			1.00	0.37				0.75	1.00	0.91	0.84	n/a
4-1/2	(114)		0.99	0.90	0.80					0.81	0.73	0.70	0.60				0.44				0.89		0.97	0.89	n/a
4-3/4	(121)		1.00	0.93	0.82					0.83	0.75	0.71	0.60				0.48				0.97		1.00	0.92	0.64
5	(127)			0.95	0.83					0.85	0.76	0.72	0.61				0.52				1.00			0.94	0.66
6	(152)			1.00	0.90					0.92	0.81	0.77	0.63				0.69							1.00	0.72
7	(178)				0.97					0.98	0.87	0.81	0.65				0.86								0.78
8	(203)				1.00					1.00	0.92	0.85	0.67				1.00								0.83
9	(229)										0.97	0.90	0.69												0.88
10	(254)										1.00	0.94	0.72												0.93
11	(279)											0.99	0.74												0.97
12	(305)											1.00	0.76												1.00
14	(356)												0.80												
16	(406)												0.85												
18	(457)												0.89												
20	(508)												0.93												
24	(610)												1.00												

1 Linear interpolation not permitted.

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering software or perform anchor calculation using design equations from ACI 318-14 Chapter 17.

3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then f_{HV} = 1.0.

If a reduction factor value is in a shaded cell, this indicates that this specific edge distance may not be permitted with a certain spacing (or vice versa). Check table 5 and figure 2 of this section to calculate permissable edge distance, spacing and concrete thickness combinations.

Table 16 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the soffit of uncracked lightweight concrete over metal deck[1,2,3,4,5,6]

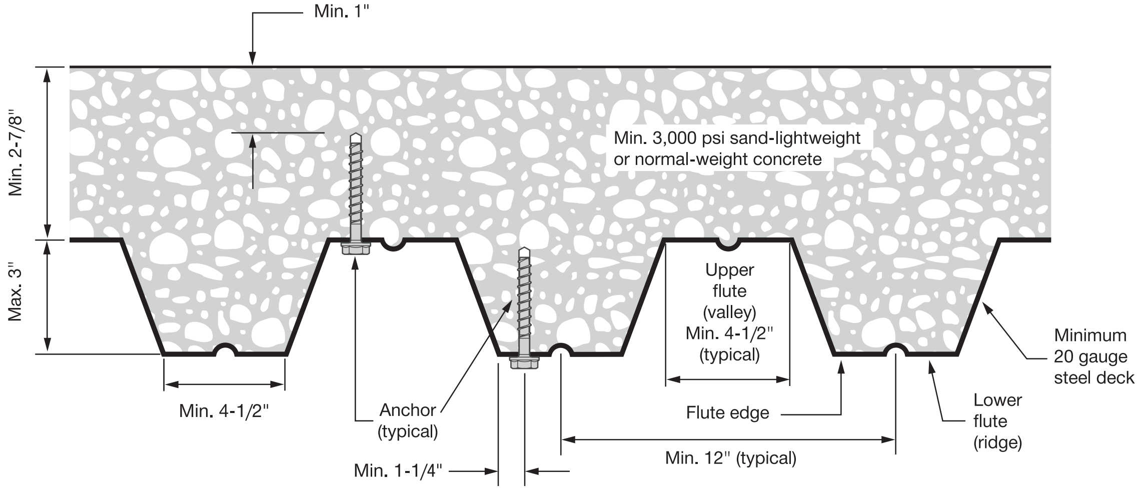
Nominal anchor diameter in.	Nominal embedment in. (mm)	Installation in lower flute				Installation in upper flute			
		Tension - ϕN_n		Shear - ϕV_n		Tension - ϕN_n		Shear - ϕV_n	
		f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)
1/4	1-5/8 (41)	545 (2.4)	595 (2.6)	725 (3.2)	725 (3.2)	670 (3.0)	730 (3.2)	725 (3.2)	725 (3.2)
	2-1/2 (64)	1,220 (5.4)	1,410 (6.3)	1,325 (5.9)	1,325 (5.9)	1,275 (5.7)	1,470 (6.5)	1,960 (8.7)	1,960 (8.7)
3/8	1-5/8 (41)	845 (3.8)	975 (4.3)	905 (4.0)	905 (4.0)	970 (4.3)	1,120 (5.0)	2,200 (9.8)	2,200 (9.8)
	2-1/2 (64)	1,455 (6.5)	1,680 (7.5)	905 (4.0)	905 (4.0)	1,900 (8.5)	2,195 (9.8)	3,655 (16.3)	3,655 (16.3)
	3-1/4 (83)	2,550 (11.3)	2,945 (13.1)	2,165 (9.6)	2,165 (9.6)	n/a	n/a	n/a	n/a
1/2	2-1/4 (57)	850 (3.8)	980 (4.4)	965 (4.3)	965 (4.3)	905 (4.0)	1,045 (4.6)	4,710 (21.0)	4,710 (21.0)
	3 (76)	1,990 (8.9)	2,300 (10.2)	1,750 (7.8)	1,750 (7.8)	n/a	n/a	n/a	n/a
	4-1/4 (108)	3,485 (15.5)	4,025 (17.9)	2,155 (9.6)	2,155 (9.6)	n/a	n/a	n/a	n/a
5/8	3-1/4 (83)	2,715 (12.1)	3,135 (13.9)	2,080 (9.3)	2,080 (9.3)	n/a	n/a	n/a	n/a
	5 (127)	6,170 (27.4)	7,125 (31.7)	2,515 (11.2)	2,515 (11.2)	n/a	n/a	n/a	n/a
3/4	4 (102)	2,715 (12.1)	3,135 (13.9)	2,255 (10.0)	2,255 (10.0)	n/a	n/a	n/a	n/a

Table 17 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the soffit of cracked lightweight concrete over metal deck[1,2,3,4,5,6]

Nominal anchor diameter in.	Nominal embedment in. (mm)	Installation in lower flute				Installation in upper flute			
		Tension - ϕN_n[7]		Shear - ϕV_n[8]		Tension - ϕN_n[7]		Shear - ϕV_n[8]	
		f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)	f'_c = 3,000 psi lb (kN)	f'_c = 4,000 psi lb (kN)
1/4	1-5/8 (41)	280 (1.2)	305 (1.4)	725 (3.2)	725 (3.2)	340 (1.5)	370 (1.6)	725 (3.2)	725 (3.2)
	2-1/2 (64)	605 (2.7)	700 (3.1)	1,325 (5.9)	1,325 (5.9)	635 (2.8)	735 (3.3)	1,960 (8.7)	1,960 (8.7)
3/8	1-5/8 (41)	525 (2.3)	605 (2.7)	905 (4.0)	905 (4.0)	770 (3.4)	890 (4.0)	2,200 (9.8)	2,200 (9.8)
	2-1/2 (64)	1,035 (4.6)	1,195 (5.3)	905 (4.0)	905 (4.0)	1,345 (6.0)	1,555 (6.9)	3,655 (16.3)	3,655 (16.3)
	3-1/4 (83)	1,805 (8.0)	2,085 (9.3)	2,165 (9.6)	2,165 (9.6)	n/a	n/a	n/a	n/a
1/2	2-1/4 (57)	535 (2.4)	620 (2.8)	965 (4.3)	965 (4.3)	640 (2.8)	740 (3.3)	4,710 (21.0)	4,710 (21.0)
	3 (76)	1,255 (5.6)	1,450 (6.4)	1,750 (7.8)	1,750 (7.8)	n/a	n/a	n/a	n/a
	4-1/4 (108)	2,195 (9.8)	2,535 (11.3)	2,155 (9.6)	2,155 (9.6)	n/a	n/a	n/a	n/a
5/8	3-1/4 (83)	1,710 (7.6)	1,975 (8.8)	2,080 (9.3)	2,080 (9.3)	n/a	n/a	n/a	n/a
	5 (127)	3,885 (17.3)	4,485 (20.0)	2,515 (11.2)	2,515 (11.2)	n/a	n/a	n/a	n/a
3/4	4 (102)	1,710 (7.6)	1,975 (8.8)	2,255 (10.0)	2,255 (10.0)	n/a	n/a	n/a	n/a

1 See PTG Ed. 19 Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{nom} (nominal embedment).
4 Tabular values are lightweight concrete and no additional reduction factor is needed.
5 No additional reduction factors for spacing or edge distance need to be applied.
6 Comparison to steel values in table 4 is not required. Values in tables 16 and 17 control.
7 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension only by $\alpha_{N,seis}$ = 0.75.
See PTG Ed. 19 Section 3.1.8 for additional information on seismic applications.
8 For the following anchor sizes, an additional factor for seismic shear must be applied to the cracked concrete tabular values for seismic conditions:
1/4-inch diameter - $\alpha_{V,seis}$ = 0.75
3/8-inch diameter - $\alpha_{V,seis}$ = 0.60
1/2-inch diameter - $\alpha_{V,seis}$ = 0.60
5/8-inch diameter - $\alpha_{V,seis}$ = 0.60
3/4-inch diameter - $\alpha_{V,seis}$ = 0.70

Figure 3 – Installation of Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in soffit of concrete over steel deck floor and roof assemblies[1]



1 Anchors may be placed in the upper or lower flute of the steel deck profile provided the minimum concrete cover above the drilled hole is satisfied. Anchors in the lower flute may be installed with a maximum 1-inch offset in either direction from the center of the flute. The offset distance may be increased proportionally for profiles with lower flute widths greater than those shown provided the minimum lower flute edge distance is also satisfied.

Figure 4 – Installation of Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC on the top of sand-lightweight concrete over metal floor and roof assemblies

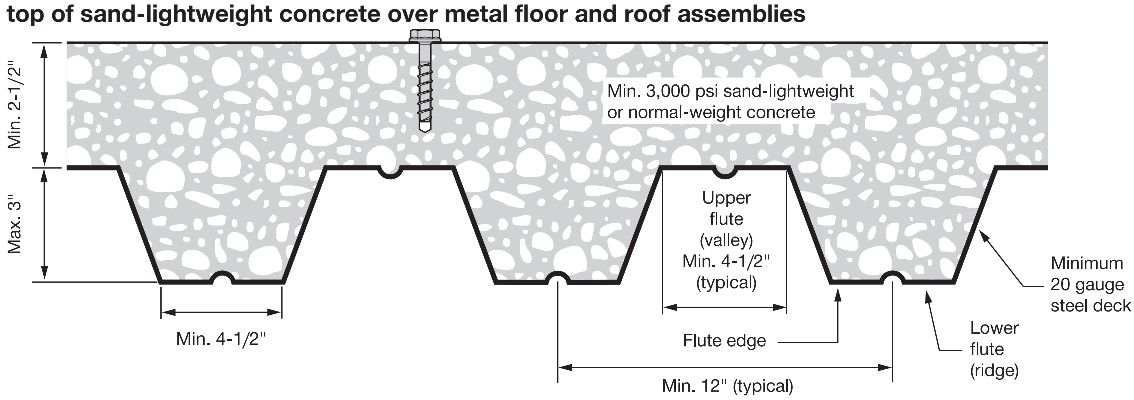


Table 18 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the top of uncracked concrete over metal deck[1,2,3,4,5]

Nominal anchor diameter in.	Nominal embedment depth in. (mm)	Tension - ϕN_n		Shear - ϕV_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
1/4	1-5/8 (41)	620 (2.8)	675 (3.0)	1,180 (5.2)	1,360 (6.0)
3/8	1-5/8 (41)	1,000 (4.4)	1,155 (5.1)	1,075 (4.8)	1,245 (5.5)

Table 19 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the top of cracked concrete over metal deck[1,2,3,4,5]

Nominal anchor diameter in.	Nominal embed. depth in. (mm)	Tension - ϕN_n		Shear - ϕV_n	
		f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)	f'_c = 3,000 psi (20.7 MPa) lb (kN)	f'_c = 4,000 psi (27.6 MPa) lb (kN)
1/4	1-5/8 (41)	315 (1.4)	345 (1.5)	835 (3.7)	965 (4.3)
3/8	1-5/8 (41)	520 (2.3)	600 (2.7)	760 (3.4)	880 (3.9)

1 See PTG Ed. 19 Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 20 and 21 as necessary. Compare to the steel values in table 4. The lesser of the values is to be used for the design.
4 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λa as follows:
for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:
1/4-inch diameter - $\alpha_{N,seis}$ = 0.60
3/8-inch diameter- $\alpha_{N,seis}$ = 0.75.
No reduction needed for seismic shear. See PTG Ed. 19 Section 3.1.8 for additional information on seismic applications.

Table 20 - Load adjustment factors for Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the top of uncracked concrete over metal deck[1,2]

1/4-in. and 3/8-in. KH-EZ uncracked concrete over metal deck			Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear[3] f_{AV}		Edge distance in shear ⊥ toward edge f_{RV}		Edge distance in shear II to and away from edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Anchor diameter d_a		in. (mm)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)
Nominal embed. h_{nom}		in. (mm)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	0.44	0.58	n/a	n/a	0.44	0.58	0.44	0.58	n/a	n/a
	2	(51)	n/a	n/a	0.50	0.67	n/a	n/a	0.50	0.67	0.50	0.67	n/a	n/a
	2-1/2	(64)	n/a	n/a	0.63	0.83	n/a	n/a	0.63	0.83	0.63	0.83	0.78	0.83
	3	(76)	0.92	0.95	0.75	1.00	0.68	0.71	0.75	1.00	0.75	1.00	0.85	0.91
	3-1/4	(83)	0.96	0.99	0.81		0.70	0.72	0.81		0.81			
	3-1/2	(89)	0.99	1.00	0.88		0.71	0.74	0.88		0.88			
	4	(102)	1.00		1.00		0.74	0.78	1.00		1.00			
	4-1/2	(114)					0.77	0.81						
	5	(127)					0.80	0.84						
	5-1/2	(140)					0.83	0.88						
	6	(152)					0.86	0.91						
	6-1/2	(165)					0.89	0.95						
	7	(178)					0.92	0.98						
	7-1/2	(191)					0.95	1.00						
	8	(203)					0.98							
	9	(229)					1.00							

Table 21 - Load adjustment factors for Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the top of cracked concrete over metal deck[1,2]

1/4-in. and 3/8-in. KH-EZ cracked concrete over metal deck			Spacing factor in tension f_{AN}		Edge distance factor in tension f_{RN}		Spacing factor in shear[3] f_{AV}		Edge distance in shear ⊥ toward edge f_{RV}		Edge distance in shear II to and away from edge f_{RV}		Conc. thickness factor in shear[4] f_{HV}	
Anchor diameter d_a		in. (mm)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)	1/4 (6.4)	3/8 (9.5)
Nominal embed. h_{nom}		in. (mm)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)	1-5/8 (41)
Spacing (s)/edge distance (c_a)/concrete thickness (h) - in. (mm)	1-3/4	(44)	n/a	n/a	0.99	1.00	n/a	n/a	0.51	0.62	0.99	1.00	n/a	n/a
	2	(51)	n/a	n/a	1.00		n/a	n/a	0.62	0.76	1.00		n/a	n/a
	2-1/2	(64)	n/a	n/a			n/a	n/a	0.87	1.00			0.78	0.83
	3	(76)	0.92	0.95			0.68	0.71	1.00				0.85	0.91
	3-1/4	(83)	0.96	0.99			0.70	0.73						
	3-1/2	(89)	0.99	1.00			0.71	0.74						
	4	(102)	1.00				0.74	0.78						
	4-1/2	(114)					0.77	0.81						
	5	(127)					0.80	0.85						
	5-1/2	(140)					0.83	0.88						
	6	(152)					0.86	0.92						
	6-1/2	(165)					0.89	0.95						
	7	(178)					0.92	0.98						
	7-1/2	(191)					0.95	1.00						
	8	(203)					0.98							
	9	(229)					1.00							

1 Linear interpolation not permitted.

2 When combining multiple load adjustment factors (e.g. for a 4 anchor pattern in a corner with thin concrete member) the design can become very conservative. To optimize the design, use Hilti PROFIS Engineering software or perform anchor calculation using design equations from ACI 318-14 Chapter 17.

3 Spacing factor reduction in shear, f_{AV}, assumes an influence of a nearby edge. If no edge exists, then $f_{AV} = f_{AN}$.

4 Concrete thickness reduction factor in shear, f_{HV}, assumes an influence of a nearby edge. If no edge exists, then f_{HV} = 1.0.

- For concrete thickness greater than or equal to 3-1/4-inches, the anchor can be designed using either table 2 or table 3 of this section.

DESIGN INFORMATION IN CONCRETE PER CSA A23.3

Limit State Design of anchors is described in the provisions of CSA A23.3-14 Annex D for post-installed anchors tested and assessed in accordance with ACI 355.2 for mechanical anchors and ACI 355.4 for adhesive anchors. This section contains the Limit State Design tables with unfactored characteristic loads that are based on the published loads in ICC Evaluation Services ESR-3027. These tables are followed by factored resistance tables. The factored resistance tables have characteristic design loads that are prefactored by the applicable reduction factors for a single anchor with no anchor-to-anchor spacing or edge distance adjustments for the convenience of the user of this document. All the figures in the previous ACI 318-14 Chapter 17 design section are applicable to Limit State Design and the tables will reference these figures.

For a detailed explanation of the tables developed in accordance with CSA A23.3-14 Annex D, refer to Section 3.1.8. Technical assistance is available by contacting Hilti Canada at (800) 363-4458 or at www.hilti.com.

Table 22 - Steel resistance for Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC carbon steel screw anchor[1,2]

Nominal anchor diameter in.	Nominal embedment in. (mm)			Tensile[3] N_{sar} lb (kN)	Shear[4] V_{sar} lb (kN)	Seismic shear[5] $V_{sar,eq}$ lb (kN)
1/4	1-5/8 (41)	2-1/2 (64)		3,370 (15.0)	855 (3.8)	770 (3.4)
3/8	1-5/8 (41)	2-1/8 (54)		5,475 (24.4)	2,030 (9.0)	2,030 (9.0)
3/8	2-1/2 (64)	3-1/4 (83)		6,150 (27.4)	2,865 (12.7)	1,720 (7.7)
1/2	2-1/4 (57)	3 (76)	4-1/4 (108)	10,780 (48.0)	5,110 (22.7)	3,065 (13.6)
5/8	3-1/4 (83)	4 (102)	5 (127)	14,405 (64.1)	6,200 (27.6)	3,720 (16.5)
3/4	4 (102)	6-1/4 (159)		19,050 (84.7)	9,205 (40.9)	6,385 (28.4)

1 See PTG Ed. 19 Section 3.1.8 to convert design strength value to ASD value.
2 Hilti KWIK HUS-EZ carbon steel screw anchors are to be considered brittle steel elements.
3 Tensile $N_{sar} = A_{se,N}\ \phi_s\ f_{uta}$ R as noted in CSA A23.3-14 Annex D.
4 Shear determined by static shear tests with $V_{sar} < 0.6\ A_{se,V}\ \phi_s\ f_{uta}$ R as noted in CSA A23.3-14 Annex D.
5 Seismic shear values determined by seismic shear tests with $V_{sar,eq} \leq 0.60\ A_{se,V}\ \phi_s\ f_{uta}$ R as noted in CSA A23.3-14 Annex D. See PTG Ed. 19 Section 3.1.9 for additional information on seismic applications.

Table 23 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC design information in accordance with CSA A23.3-14 Annex D1[1]

Design parameter	Symbol	Units	Nominal anchor diameter														Ref
			1/4		3/8				1/2			5/8			3/4		A23.3-14
Head Style and coating			Hex, P, PM, PL, C head		Hex, C head		Hex, C head (Including CRC)		Hex head (Including CRC)			Hex head (Including CRC)			Hex head (Including CRC)		
Nominal anchor diameter	d_a	in. (mm)	0.25 (6.4)		0.375 (9.5)				0.5 (12.7)			0.625 (15.9)			0.75 (19.1)		
Effective embedment[2]	h_{ef}	in. (mm)	1.18 (30)	1.92 (49)	1.11 (28)	1.54 (39)	1.86 (47)	2.50 (64)	1.52 (39)	2.16 (55)	3.22 (82)	2.39 (61)	3.03 (77)	3.88 (99)	2.92 (74)	4.84 (123)	
Min. nominal embedment[2]	h_{nom}	in. (mm)	1-5/8 (41)	2-1/2 (64)	1-5/8 (41)	2-1/8 (54)	2-1/2 (64)	3-1/4 (83)	2-1/4 (57)	3 (76)	4-1/4 (108)	3-1/4 (83)	4 (102)	5 (127)	4 (102)	6-1/4 (159)	
Minimum concrete thickness[3]	h_{min}	in. (mm)	3-1/4 (83)	4-1/8 (105)	3-1/4 (83)	3-2/3 (93)	4 (102)	4-3/4 (121)	4-1/2 (114)	4-3/4 (121)	6-3/4 (171)	5 (127)	6 (152)	7 (178)	6 (152)	8-1/8 (206)	
Critical edge distance	c_{ac}	in. (mm)	2 (51)	2.78 (71)	2.63 (67)	2.75 (70)	2.92 (74)	3.75 (95)	2.75 (70)	3.75 (95)	5.25 (133)	3.63 (92)	4.57 (116)	5.82 (148)	4.41 (112)	7.28 (185)	
Minimum spacing at critical edge distance	$s_{min,cac}$	in. (mm)	1.5 (38)		2.25 (57)				3 (76)								
Minimum edge distance	c_{min}	in. (mm)	1.50 (38)						1.75 (44)								
Minimum anchor spacing at minimum edge distance	for s >	in. (mm)	3.0 (76)									4 (102)					
Mininimum hole depth in concrete	h_0	in. (mm)	2 (51)	2-7/8 (73)	1-7/8 (48)	2-3/8 (60)	2-3/4 (70)	3-1/2 (89)	2-5/8 (67)	3-3/8 (86)	4-5/8 (117)	3-5/8 (92)	4-3/8 (111)	5-3/8 (137)	4-3/8 (111)	6-5/8 (168)	
Minimum specified ultimate strength	f_{uta}	psi (N/mm²)	125,000 (860)		106,975 (738)		120,300 (830)		112,540 (776)			90,180 (622)			81,600 (563)		
Effective tensile stress area	$A_{se,N}$	in² (mm²)	0.045 (29.0)		0.086 (55.5)				0.161 (103.9)			0.268 (172.9)			0.392 (252.9)		
Steel embed. material resistance factor for reinforcement	ϕ_s	-	0.85														8.4.3
Resistance modification factor for tension, steel failure modes[4]	R	-	0.70														D.5.3
Resistance modification factor for shear, steel failure modes[4]	R	-	0.65														D.5.3
Factored steel resistance in tension	N_{sar}	lb (kN)	3,370 (15.0)		5,475 (24.4)		6,150 (27.4)		10,780 (48.0)			14,405 (64.1)			19,050 (84.7)		D.6.1.2
Factored steel resistance in shear	V_{sar}	lb (kN)	855 (3.8)		2,030 (9.0)		2,865 (12.7)		5,110 (22.7)			6,200 (27.6)			9,205 (40.9)		D.7.1.2
Factored steel resistance in shear, seismic	$V_{sar,eq}$	lb (kN)	770 (3.4)		2,030 (9.0)		1,720 (7.7)		3,065 (13.6)			3,720 (16.5)			6,385 (28.4)		
Coeff. for factored conc. breakout resistance, uncracked concrete	$k_{c,uncr}$	lb	10						11.25								D.6.2.2
Coeff. for factored conc. breakout resistance, cracked concrete	$k_{c,cr}$	-	7														D.6.2.2
Modification factor for anchor resistance, tension, uncracked concrete[5]	$\psi_{c,N}$	-	1.0														D.6.2.6
Anchor category	-	-	3	1													D.5.3 (c)
Concrete material resistance factor	ϕ_c	-	0.65														8.4.2
Resistance modification factor for tension and shear, concrete failure modes, Condition B[6]	R	-	0.75	1.00													D.5.3 (c)
Factored pullout resistance in 20 MPa uncracked concrete[7]	$N_{pr,uncr}$	lb (kN)	665 (3.0)	1,645 (7.3)	NA												D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete[7]	$N_{pr,cr}$	lb (kN)	340 (1.5)	815 (3.6)	510 (2.3)	NA											D.6.3.2
Factored seismic pullout resistance in 20 MPa cracked concrete[7]	$N_{pr,eq}$	lb (kN)	275 (1.2)	815 (3.6)	510 (2.3)	NA											D.6.3.2

1 Design information in this table is taken from ICC-ES ESR-3027, dated February, 2016, tables 2, 3, and 4, and converted for use with CSA A23.3-14 Annex D.
2 See Figure 1 on Page 2 of this document.
3 For concrete over metal deck applications where the concrete thickness over the top flute is less than h_{min} in this table, see figure 4 and tables 20 and 21 of this document.
4 The KWIK HUS-EZ is considered a brittle steel element as defined by CSA A23.3-14 Annex D section D.2.
5 For all design cases, $\psi_{c,N}$ = 1.0. The appropriate coefficient for breakout resistance for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.
6 For use with the load combinations of CSA A23.3-14 chapter 8. Condition B applies where supplementary reinforcement in conformance with CSA A23.3-14 section D.5.3 is not provided, or where pullout or pryout strength governs. For cases where the presence of supplementary reinforcement can be verified, the resistance modification factors associated with Condition A may be used.
7 For all design cases, $\psi_{c,P}$ = 1.0. NA (not applicable) denotes that this value does not control for design. See section 4.1.4 of ESR-3027 for additional information.

Table 24 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC carbon steel screw anchor factored resistance with concrete/pullout failure in uncracked concrete[1,2,3,4]

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_r				Shear - V_r			
			f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
1/4	1.18 (30)	1-5/8 (41)	665 (3.0)	710 (3.2)	750 (3.3)	820 (3.6)	805 (3.6)	900 (4.0)	985 (4.4)	1,135 (5.1)
	1.92 (49)	2-1/2 (64)	1,645 (7.3)	1,840 (8.2)	2,015 (9.0)	2,325 (10.4)	2,225 (9.9)	2,490 (11.1)	2,725 (12.1)	3,145 (14.0)
3/8	1.11 (28)	1-5/8 (41)	980 (4.4)	1,095 (4.9)	1,200 (5.3)	1,385 (6.2)	980 (4.4)	1,095 (4.9)	1,200 (5.3)	1,385 (6.2)
	1.54 (39)	2-1/8 (54)	1,600 (7.1)	1,785 (8.0)	1,960 (8.7)	2,260 (10.1)	1,600 (7.1)	1,785 (8.0)	1,960 (8.7)	2,260 (10.1)
	1.86 (47)	2-1/2 (64)	2,120 (9.4)	2,375 (10.6)	2,600 (11.6)	3,000 (13.3)	2,120 (9.4)	2,375 (10.6)	2,600 (11.6)	3,000 (13.3)
	2.50 (64)	3-1/4 (83)	3,305 (14.7)	3,695 (16.4)	4,050 (18.0)	4,675 (20.8)	3,305 (14.7)	3,695 (16.4)	4,050 (18.0)	4,675 (20.8)
1/2	1.52 (39)	2-1/4 (57)	1,765 (7.8)	1,970 (8.8)	2,160 (9.6)	2,495 (11.1)	1,765 (7.8)	1,970 (8.8)	2,160 (9.6)	2,495 (11.1)
	2.16 (55)	3 (76)	2,990 (13.3)	3,340 (14.9)	3,660 (16.3)	4,225 (18.8)	2,990 (13.3)	3,340 (14.9)	3,660 (16.3)	4,225 (18.8)
	3.22 (82)	4-1/4 (108)	5,440 (24.2)	6,080 (27.0)	6,660 (29.6)	7,690 (34.2)	10,875 (48.4)	12,160 (54.1)	13,320 (59.3)	15,380 (68.4)
5/8	2.39 (61)	3-1/4 (83)	3,475 (15.5)	3,890 (17.3)	4,260 (18.9)	4,920 (21.9)	3,475 (15.5)	3,890 (17.3)	4,260 (18.9)	4,920 (21.9)
	3.03 (77)	4 (102)	4,985 (22.2)	5,573 (24.8)	6,105 (27.2)	7,049 (31.4)	10,736 (47.8)	12,004 (53.4)	13,149 (58.5)	15,183 (67.5)
	3.88 (99)	5 (127)	7,195 (32.0)	8,040 (35.8)	8,810 (39.2)	10,170 (45.2)	14,385 (64.0)	16,085 (71.5)	17,620 (78.4)	20,345 (90.5)
3/4	2.92 (74)	4 (102)	4,695 (20.9)	5,250 (23.4)	5,750 (25.6)	6,640 (29.5)	9,390 (41.8)	10,500 (46.7)	11,505 (51.2)	13,280 (59.1)
	4.84 (123)	6-1/4 (159)	10,020 (44.6)	11,205 (49.8)	12,275 (54.6)	14,170 (63.0)	20,040 (89.2)	22,410 (99.7)	24,545 (109.2)	28,345 (126.1)

Table 25 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC carbon steel screw anchor factored resistance with concrete/pullout failure in cracked concrete[1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_r				Shear - V_r			
			f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
1/4	1.18 (30)	1-5/8 (41)	340 (1.5)	360 (1.6)	385 (1.7)	415 (1.9)	565 (2.5)	630 (2.8)	690 (3.1)	795 (3.5)
	1.92 (49)	2-1/2 (64)	815 (3.6)	910 (4.1)	1,000 (4.4)	1,155 (5.1)	1,560 (6.9)	1,740 (7.7)	1,910 (8.5)	2,205 (9.8)
3/8	1.11 (28)	1-5/8 (41)	510 (2.3)	570 (2.5)	620 (2.8)	720 (3.2)	685 (3.0)	765 (3.4)	840 (3.7)	970 (4.3)
	1.54 (39)	2-1/8 (54)	1,120 (5.0)	1,250 (5.6)	1,370 (6.1)	1,585 (7.0)	1,120 (5.0)	1,250 (5.6)	1,370 (6.1)	1,585 (7.0)
	1.86 (47)	2-1/2 (64)	1,485 (6.6)	1,660 (7.4)	1,820 (8.1)	2,100 (9.3)	1,485 (6.6)	1,660 (7.4)	1,820 (8.1)	2,100 (9.3)
	2.50 (64)	3-1/4 (83)	2,315 (10.3)	2,590 (11.5)	2,835 (12.6)	3,275 (14.6)	2,315 (10.3)	2,590 (11.5)	2,835 (12.6)	3,275 (14.6)
1/2	1.52 (39)	2-1/4 (57)	1,095 (4.9)	1,225 (5.5)	1,345 (6.0)	1,550 (6.9)	1,095 (4.9)	1,225 (5.5)	1,345 (6.0)	1,550 (6.9)
	2.16 (55)	3 (76)	1,860 (8.3)	2,080 (9.2)	2,275 (10.1)	2,630 (11.7)	1,860 (8.3)	2,080 (9.2)	2,275 (10.1)	2,630 (11.7)
	3.22 (82)	4-1/4 (108)	3,385 (15.1)	3,785 (16.8)	4,145 (18.4)	4,785 (21.3)	6,765 (30.1)	7,565 (33.7)	8,290 (36.9)	9,570 (42.6)
5/8	2.39 (61)	3-1/4 (83)	2,165 (9.6)	2,420 (10.8)	2,650 (11.8)	3,060 (13.6)	2,165 (9.6)	2,420 (10.8)	2,650 (11.8)	3,060 (13.6)
	3.03 (77)	4 (102)	3,139 (14.0)	3,509 (15.6)	3,844 (17.1)	4,439 (19.7)	6,760 (30.1)	7,558 (33.6)	8,279 (36.8)	9,560 (42.5)
	3.88 (99)	5 (127)	4,475 (19.9)	5,005 (22.3)	5,480 (24.4)	6,330 (28.2)	8,950 (39.8)	10,005 (44.5)	10,965 (48.8)	12,660 (56.3)
3/4	2.92 (74)	4 (102)	2,920 (13.0)	3,265 (14.5)	3,580 (15.9)	4,130 (18.4)	5,845 (26.0)	6,535 (29.1)	7,155 (31.8)	8,265 (36.8)
	4.84 (123)	6-1/4 (159)	6,235 (27.7)	6,970 (31.0)	7,635 (34.0)	8,820 (39.2)	12,470 (55.5)	13,945 (62.0)	15,275 (67.9)	17,635 (78.4)

1 See PTG Ed. 19 Section 3.1.8 to convert factored resistance value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 6 to 15 as necessary. Compare to the steel values in table 22. The lesser of the values is to be used for the design.
4 Tablular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:
1/4-in diameter by 1-5/8-in nominal embedment depth - $\alpha_{N,seis}$ = 0.60 All other sizes - $\alpha_{N,seis}$ = 0.75
No reduction needed for seismic shear. See PTG Ed. 19 Section 3.1.8 for additional information on seismic applications.

Table 26 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the soffit of uncracked lightweight concrete over metal deck[1,2,3,4,5,6]

Nominal anchor diameter in.	Nominal embedment in. (mm)	Installation in lower flute				Installation in upper flute			
		Tension - N_r		Shear - V_r		Tension - N_r		Shear - V_r	
		f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)
1/4	1-5/8 (41)	585 (2.6)	660 (2.9)	665 (3.0)	665 (3.0)	720 (3.2)	810 (3.6)	665 (3.0)	665 (3.0)
	2-1/2 (64)	1,200 (5.3)	1,470 (6.5)	1,220 (5.4)	1,220 (5.4)	1,255 (5.6)	1,535 (6.8)	1,805 (8.0)	1,805 (8.0)
3/8	1-5/8 (41)	830 (3.7)	1,020 (4.5)	835 (3.7)	835 (3.7)	950 (4.2)	1,165 (5.2)	2,030 (9.0)	2,030 (9.0)
	2-1/2 (64)	1,430 (6.4)	1,755 (7.8)	835 (3.7)	835 (3.7)	1,865 (8.3)	2,285 (10.2)	3,365 (15.0)	3,365 (15.0)
	3-1/4 (83)	2,505 (11.1)	3,070 (13.7)	1,990 (8.9)	1,990 (8.9)	n/a	n/a	n/a	n/a
1/2	2-1/4 (57)	835 (3.7)	1,020 (4.5)	885 (3.9)	885 (3.9)	890 (4.0)	1,090 (4.8)	4,335 (19.3)	4,335 (19.3)
	3 (76)	1,955 (8.7)	2,395 (10.7)	1,615 (7.2)	1,615 (7.2)	n/a	n/a	n/a	n/a
	4-1/4 (108)	3,425 (15.2)	4,195 (18.7)	1,985 (8.8)	1,985 (8.8)	n/a	n/a	n/a	n/a
5/8	3-1/4 (83)	2,670 (11.9)	3,270 (14.5)	1,915 (8.5)	1,915 (8.5)	n/a	n/a	n/a	n/a
	5 (127)	6,070 (27.0)	7,430 (33.1)	2,315 (10.3)	2,315 (10.3)	n/a	n/a	n/a	n/a
3/4	4 (102)	2,670 (11.9)	3,270 (14.5)	2,075 (9.2)	2,075 (9.2)	n/a	n/a	n/a	n/a

Table 27 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC in the soffit of cracked lightweight concrete over metal deck[1,2,3,4,5,6]

Nominal anchor diameter in.	Nominal embedment in. (mm)	Installation in lower flute				Installation in upper flute			
		Tension - N_r[7]		Shear - V_r[8]		Tension - N_r[7]		Shear - V_r[8]	
		f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)	f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350psi) lb (kN)
1/4	1-5/8 (41)	300 (1.3)	340 (1.5)	665 (3.0)	665 (3.0)	365 (1.6)	445 (2.0)	665 (3.0)	665 (3.0)
	2-1/2 (64)	595 (2.6)	730 (3.2)	1,220 (5.4)	1,220 (5.4)	625 (2.8)	765 (3.4)	1,805 (8.0)	1,805 (8.0)
3/8	1-5/8 (41)	520 (2.3)	635 (2.8)	835 (3.7)	835 (3.7)	755 (3.4)	930 (4.1)	2,030 (9.0)	2,030 (9.0)
	2-1/2 (64)	1,015 (4.5)	1,245 (5.5)	835 (3.7)	835 (3.7)	1,325 (5.9)	1,620 (7.2)	3,365 (15.0)	3,365 (15.0)
	3-1/4 (83)	1,775 (7.9)	2,175 (9.7)	1,990 (8.9)	1,990 (8.9)	n/a	n/a	n/a	n/a
1/2	2-1/4 (57)	525 (2.3)	640 (2.8)	885 (3.9)	885 (3.9)	630 (2.8)	770 (3.4)	4,335 (19.3)	4,335 (19.3)
	3 (76)	1,235 (5.5)	1,510 (6.7)	1,615 (7.2)	1,615 (7.2)	n/a	n/a	n/a	n/a
	4-1/4 (108)	2,155 (9.6)	2,640 (11.7)	1,985 (8.8)	1,985 (8.8)	n/a	n/a	n/a	n/a
5/8	3-1/4 (83)	1,680 (7.5)	2,060 (9.2)	1,915 (8.5)	1,915 (8.5)	n/a	n/a	n/a	n/a
	5 (127)	3,820 (17.0)	4,680 (20.8)	2,315 (10.3)	2,315 (10.3)	n/a	n/a	n/a	n/a
3/4	4 (102)	1,680 (7.5)	2,060 (9.2)	2,075 (9.2)	2,075 (9.2)	n/a	n/a	n/a	n/a

1. See PTG Ed. 19 Section 3.1.8 to convert design strength value to ASD value.
2. Linear interpolation between embedment depths and concrete compresive strengths is not permitted.
3. Tabular value is for one anchor per flute. Minimum spacing along the length of the flute is 3 x h_{nom} (nominal embedment).
4. Tabular values are lightweight concrete and no additional reduction factor is needed.
5. No additional reduction factors for spacing or edge distance need to be applied.
6. Comparison of the tabular values to the steel strength is not necessary. Tabular values control.
7. Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:
   1/4-in diameter by 1-5/8-in nominal embedment depth - $\alpha_{N,seis}$ = 0.60
   All other sizes - $\alpha_{N,seis}$ = 0.75.
   See PTG Ed. 19 Section 3.1.8 for additional information on seismic applications.
8. For the following anchor sizes, an additional factor for seismic shear must be applied to the cracked concrete tabular values for seismic conditions:
   1/4-inch diameter - $\alpha_{v,seis}$ = 0.75
   3/8-inch diameter - $\alpha_{v,seis}$ = 0.60
   1/2-inch diameter - $\alpha_{v,seis}$ = 0.60
   5/8-inch diameter - $\alpha_{v,seis}$ = 0.60
   3/4-inch diameter - $\alpha_{v,seis}$ = 0.70

Table 28 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC steel screw anchor factored resistance in the top of uncracked concrete over metal deck[1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_r		Shear - V_r	
			f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
1/4	1.18 (30)	1-5/8 (41)	665 (3.0)	750 (3.3)	805 (3.6)	985 (4.4)
3/8	1.11 (28)	1-5/8 (41)	980 (4.4)	1,200 (5.3)	980 (4.4)	1,200 (5.3)

Table 29 - Hilti KH-EZ, KH-EZ P, KH-EZ PM, KH-EZ PL, KH-EZ C and KH-EZ CRC steel anchor factored resistance in the top of cracked concrete over metal deck[1,2,3,4,5]

Nominal anchor diameter in.	Effective embed. in. (mm)	Nominal embed. in. (mm)	Tension - N_r		Shear - V_r	
			f'_c = 20 MPa (2,900psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)
1/4	1.18 (30)	1-5/8 (41)	340 (1.5)	385 (1.7)	565 (2.5)	690 (3.1)
3/8	1.11 (28)	1-5/8 (41)	510 (2.3)	620 (2.8)	685 (3.0)	840 (3.7)

1 See PTG Ed. 19 Section 3.1.8 to convert design strength value to ASD value.
2 Linear interpolation between embedment depths and concrete compressive strengths is not permitted.
3 Apply spacing, edge distance, and concrete thickness factors in tables 20 and 21 as necessary. Compare to the steel values in table 22. The lesser of the values is to be used for the design.
4 Tabular values are for normal-weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: for sand-lightweight, λ_a = 0.68; for all-lightweight, λ_a = 0.60
5 Tabular values are for static loads only. Seismic design is not permitted for uncracked concrete. For seismic tension loads, multiply cracked concrete tabular values in tension by the following reduction factors:
1/4-inch diameter - $\alpha_{N,seis}$ = 0.60
3/8-inch diameter- $\alpha_{N,seis}$ = 0.75.
No reduction needed for seismic shear. See PTG Ed. 19 Section 3.1.8 for additional information on seismic applications.

Titen HD® Heavy-Duty Screw Anchor

A high-strength screw anchor for use in cracked and uncracked concrete, as well as uncracked masonry. The Titen HD offers low installation torque and outstanding performance. Designed for use in dry, interior, non-corrosive environments or temporary outdoor applications.

Features

- Tested in accordance with ACI 355.2, AC193 and AC106
- Qualified for static and seismic loading conditions
- Thread design undercuts to efficiently transfer the load to the base material
- Standard fractional sizes
- Specialized heat-treating process creates tip hardness for better cutting without compromising the ductility
- No special drill bit required — designed to install using standard-sized ANSI tolerance drill bits
- Hex-washer head requires no separate washer, unless required by code, and provides a clean installed appearance
- Removable — ideal for temporary anchoring (e.g. formwork, bracing) or applications where fixtures may need to be moved
- Reuse of the anchor will not achieve listed loads and is not recommended

Codes: ICC-ES ESR-2713 (concrete);
ICC-ES ESR-1056 (masonry);
City of LA Supplement within ESR-2713 (concrete);
City of LA Supplement within ESR-1056 (masonry);
Florida FL15730 (concrete and masonry);
FM 3017082, 3035761 and 3043442;
Multiple DOT listings

Material: Carbon steel

Coating: Zinc plated or mechanically galvanized.
Not recommended for permanent exterior use or highly corrosive environments.

Titen HD Screw Anchor

Cracked Concrete CODE LISTED

Serrated teeth on the tip of the Titen HD® screw anchor facilitate cutting and reduce installation torque.

Installation

⚠ Holes in steel fixtures to be mounted should match the diameter specified in the table below.

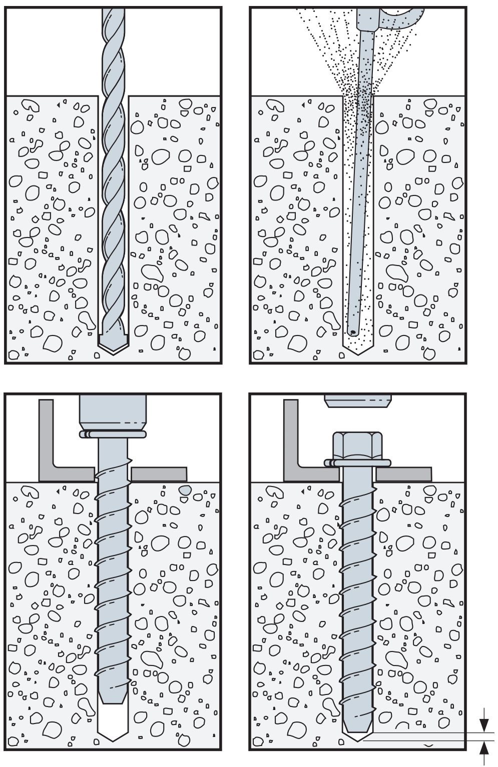
Use a Titen HD screw anchor one time only — installing the anchor multiple times may result in excessive thread wear and reduce load capacity.

⚠ Do not use impact wrenches to install into hollow CMU.

⚠ **Caution:** Oversized holes in base material will reduce or eliminate the mechanical interlock of the threads with the base material and reduce the anchor's load capacity.

1. Drill a hole in the base material using a carbide drill bit the same diameter as the nominal diameter of the anchor to be installed. Drill the hole to the specified embedment depth plus minimum hole depth overdrill (see table below) to allow the thread tapping dust to settle, and blow it clean using compressed air. (Overhead installations need not be blown clean.) Alternatively, drill the hole deep enough to accommodate embedment depth and the dust from drilling and tapping.
2. Insert the anchor through the fixture and into the hole.
3. Tighten the anchor into the base material until the hex-washer head contacts the fixture.

Installation Sequence



Additional Installation Information

Titen HD® Diameter (in.)	Wrench Size (in.)	Recommended Steel Fixture Hole Size (in.)	Minimum Hole Depth Overdrill (in.)
¼	⅜	⅜ to 7/16	⅛
⅜	9/16	½ to 9/16	¼
½	¾	⅝ to 11/16	½
⅝	15/16	¾ to 13/16	½
¾	1⅛	⅞ to 15/16	½

Suggested fixture hole sizes are for structural steel thicker than 12 gauge only. Larger holes are not required for wood or thinner cold-formed steel members.

Titen HD® Heavy-Duty Screw Anchor

Titen HD Anchor Product Data — Zinc Plated

Size (in.)	Model No.	Thread Length (in.)	Drill Bit Diameter (in.)	Wrench Size (in.)	Quantity	
					Box	Carton
¼ x 1⅞	THDB25178H	1½	¼	⅜	100	500
¼ x 2¾	THDB25234H	2⅜	¼	⅜	50	250
¼ x 3	THDB25300H	2⅝	¼	⅜	50	250
¼ x 3½	THDB25312H	3⅛	¼	⅜	50	250
¼ x 4	THDB25400H	3⅝	¼	⅜	50	250
⅜ x 1¾	THD37134H†	1¼	⅜	9/16	50	250
⅜ x 2½	THD37212H†	2	⅜	9/16	50	200
⅜ x 3	THD37300H	2½	⅜	9/16	50	200
⅜ x 4	THD37400H	3½	⅜	9/16	50	200
⅜ x 5	THD37500H	4½	⅜	9/16	50	100
⅜ x 6	THD37600H	5½	⅜	9/16	50	100
½ x 3	THD50300H	2½	½	¾	25	100
½ x 4	THD50400H	3½	½	¾	20	80
½ x 5	THD50500H	4½	½	¾	20	80
½ x 6	THD50600H	5½	½	¾	20	80
½ x 6½	THD50612H	5½	½	¾	20	40
½ x 8	THD50800H	5½	½	¾	20	40
½ x 12	THD501200H	5½	½	¾	5	25
½ x 13	THD501300H	5½	½	¾	5	25
½ x 14	THD501400H	5½	½	¾	5	25
½ x 15	THD501500H	5½	½	¾	5	25
⅝ x 4	THDB62400H	3½	⅝	15/16	10	40
⅝ x 5	THDB62500H	4½	⅝	15/16	10	40
⅝ x 6	THDB62600H	5½	⅝	15/16	10	40
⅝ x 6½	THDB62612H	5½	⅝	15/16	10	40
⅝ x 8	THDB62800H	5½	⅝	15/16	10	20
⅝ x 10	THDB62100H	5½	⅝	15/16	10	20
¾ x 4	THD75400H	3½	¾	1⅛	10	40
¾ x 5	THD75500H	4½	¾	1⅛	5	20
¾ x 6	THDT75600H	4½	¾	1⅛	5	20
¾ x 7	THD75700H	5½	¾	1⅛	5	10
¾ x 8½	THD75812H	5½	¾	1⅛	5	10
¾ x 10	THD75100H	5½	¾	1⅛	5	10

† These models do not meet minimum embedment depth requirements for strength design and require maximum installation torque of 25 ft. – lb. using a torque wrench, driver drill or cordless ¼" impact driver with a maximum permitted torque rating of 100 ft. – lb.

1. Length of anchor is measured from underside of head to end of anchor.

Titen HD® Heavy-Duty Screw Anchor

Titen HD Anchor Product Data — Mechanically Galvanized

Size (in.)	Model No.	Thread Length (in.)	Drill Bit Diameter (in.)	Wrench Size (in.)	Quantity	
					Box	Carton
⅜ x 3	THD37300HMG	2½	⅜	9⁄16	50	200
⅜ x 4	THD37400HMG	3½			50	200
⅜ x 5	THD37500HMG	4½			50	100
⅜ x 6	THD37600HMG	5½			50	100
½ x 4	THD50400HMG	3½	½	¾	20	80
½ x 5	THD50500HMG	4½			20	80
½ x 6	THD50600HMG	5½			20	80
½ x 6½	THD50612HMG	5½			20	40
½ x 8	THD50800HMG	5½			20	40
½ x 12	THD501200HMG	5½			5	20
⅝ x 5	THDB62500HMG	4½	⅝	15⁄16	10	40
⅝ x 6	THDB62600HMG	5½			10	40
⅝ x 6½	THDB62612HMG	5½			10	40
⅝ x 8	THDB62800HMG	5½			10	20
¾ x 5	THD75500HMG	4½	¾	1⅛	5	20
¾ x 6	THDT75600HMG	4½			5	20
¾ x 8½	THD75812HMG	5½			5	10
¾ x 10	THD75100HMG	5½			5	10

Mechanical galvanizing meets ASTM B695, Class 65, Type 1. Intended for some pressure-treated wood sill plate applications. Not for use in other corrosive or outdoor environments. See p. 261 or visit **strongtie.com/info** for more corrosion information.

Titen HD Installation Information and Additional Data[1]

IBC *

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)										
			¼		⅜		½		⅝		¾		
Installation Information													
Drill Bit Diameter	d_{bit}	in.	¼		⅜		½		⅝		¾		
Baseplate Clearance Hole Diameter	d_c	in.	⅜		½		⅝		¾		⅞		
Maximum Installation Torque	$T_{inst,max}$	ft.-lbf	24[2]		50[2]		65[2]		100[2]		150[2]		
Maximum Impact Wrench Torque Rating	$T_{impact,max}$	ft.-lbf	125[3]		150[3]		340[3]		340[3]		385[3]		
Minimum Hole Depth	h_{hole}	in.	1¾	2⅝	2¾	3½	3¾	4½	4½	6	4½	6	6¾
Nominal Embedment Depth	h_{nom}	in.	1⅝	2½	2½	3¼	3¼	4	4	5½	4	5½	6¼
Critical Edge Distance	c_{ac}	in.	3	6	2 11⁄16	3⅝	3 9⁄16	4½	4½	6⅜	6	6⅜	7 5⁄16
Minimum Edge Distance	c_{min}	in.	1½		1¾								
Minimum Spacing	s_{min}	in.	1½		3						2¾	3	
Minimum Concrete Thickness	h_{min}	in.	3¼	3½	4	5	5	6¼	6	8½	6	8¾	10
Additional Data													
Anchor Category	Category	—	1										
Yield Strength	f_{ya}	psi	100,000		97,000								
Tensile Strength	f_{uta}	psi	125,000		110,000								
Minimum Tensile and Shear Stress Area	A_{se}	in²	0.042		0.099		0.183		0.276		0.414		
Axial Stiffness in Service Load Range — Uncracked Concrete	β_{uncr}	lb./in.	202,000		672,000								
Axial Stiffness in Service Load Range — Cracked Concrete	β_{cr}	lb./in.	173,000		345,000								

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 and ACI 318-11 Appendix D.
2. $T_{inst,max}$ is the maximum permitted installation torque for the embedment depth range covered by this table using a torque wrench.
3. $T_{impact,max}$ is the maximum permitted torque rating for impact wrenches for the embedment depth range covered by this table.

* See p. 12 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

Titen HD Tension Strength Design Data[1]

IBC *

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)										
			¼		⅜		½		⅝		¾		
Nominal Embedment Depth	h_{nom}	in.	1⅝	2½	2½	3¼	3¼	4	4	5½	4	5½	6¼
Steel Strength in Tension — ACI 318-14 Section 17.4.1 or ACI 318-11 Section D.5.1													
Tension Resistance of Steel	N_{sa}	lb.	5,195		10,890		20,130		30,360		45,540		
Strength Reduction Factor — Steel Failure	ϕ_{sa}	—	0.65[2]										
Concrete Breakout Strength in Tension[6] — ACI 318-14 Section 17.4.2 or ACI 318-11 Section D.5.2													
Effective Embedment Depth	h_{ef}	in.	1.19	1.94	1.77	2.40	2.35	2.99	2.97	4.24	2.94	4.22	4.86
Critical Edge Distance[6]	c_{ac}	in.	3	6	2¹¹⁄₁₆	3⅝	3⁹⁄₁₆	4½	4½	6⅜	6	6⅜	7⁵⁄₁₆
Effectiveness Factor — Uncracked Concrete	k_{uncr}	—	30	24							27	24	
Effectiveness Factor — Cracked Concrete	k_{cr}	—	17										
Modification Factor	$\psi_{c,N}$	—	1.0										
Strength Reduction Factor — Concrete Breakout Failure	ϕ_{cb}	—	0.65[7]										
Pullout Strength in Tension — ACI 318-14 Section 17.4.3 or ACI 318-11 Section D.5.3													
Pullout Resistance, Uncracked Concrete (f'_c = 2,500 psi)	$N_{p,uncr}$	lb.	—[3]	—[3]	2,700[4]	—[3]	—[3]	—[3]	—[3]	9,810[4]	—[3]	—[3]	—[3]
Pullout Resistance, Cracked Concrete (f'_c = 2,500 psi)	$N_{p,cr}$	lb.	—[3]	1,905[4]	1,235[4]	2,700[4]	—[3]	—[3]	3,040[4]	5,570[4]	—[3]	6,070[4]	7,195[4]
Strength Reduction Factor — Concrete Pullout Failure	ϕ_p	—	0.65[5]										
Tension Strength for Seismic Applications — ACI 318-14 Section 17.4.2.3.3 or ACI 318-11 Section D.3.3.3													
Nominal Pullout Strength for Seismic Loads (f'_c = 2,500 psi)	$N_{p,eq}$	lb.	—[3]	1,905[4]	1,235[4]	2,700[4]	—[3]	—[3]	3,040[4]	5,570[4]	3,840[4]	6,070[4]	7,195[4]
Strength Reduction Factor — Breakout or Pullout Failure	ϕ_{eq}	—	0.65[5]										

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 and ACI 318-11 Appendix D, except as modified below.
2. The tabulated value of ϕ_{sa} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{sa} must be determined in accordance with ACI 318-11 D.4.4. Anchors are considered brittle steel elements.
3. Pullout strength is not reported since concrete breakout controls.
4. Adjust the characteristic pullout resistance for other concrete compressive strengths by multiplying the tabular value by $(f'_{c,specified} / 2{,}500)^{0.5}$.
5. The tabulated value of ϕ_p or ϕ_{eq} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3.(c) or ACI 318-11 D.4.3(c) for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, appropriate value of ϕ must be determined in accordance with ACI 318-11 Section D.4.4(c).
6. The modification factor $\psi_{cp,N}$ = 1.0 for cracked concrete. Otherwise, the modification factor for uncracked concrete without supplementary reinforcement to control splitting is either:
   (1) $\psi_{cp,N} = 1.0$ if $c_{a,min} \geq c_{ac}$ or (2) $\psi_{cp,N} = \frac{c_{a,min}}{c_{ac}} \geq \frac{1.5h_{ef}}{c_{ac}}$ if $c_{a,min} < c_{ac}$
   The modification factor, $\psi_{cp,N}$ is applied to the nominal concrete breakout strength, N_{cb} or N_{cbg}.
7. The tabulated value of ϕ_{cb} applies when both the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided. For installations where complying supplementary reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition A are allowed. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{cb} must be determined in accordance with ACI 318-11 D.4.4(c).

* See p. 12 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

Titen HD Shear Strength Design Data[1]

Characteristic	Symbol	Unit	Nominal Anchor Diameter, d_a (in.)										
			¼		⅜		½		⅝		¾		
Nominal Embedment Depth	h_{nom}	in.	1⅝	2½	2½	3¼	3¼	4	4	5½	4	5½	6¼
Steel Strength in Shear													
Shear Resistance of Steel	V_{sa}	lb.	2,020		4,460		7,455		10,000		14,950	16,840	
Strength Reduction Factor — Steel Failure	ϕ_{sa}	—	0.60[2]										
Concrete Breakout Strength in Shear													
Outside Diameter	d_a	in.	0.25		0.375		0.500		0.625		0.750		
Load Bearing Length of Anchor in Shear	ℓ_e	in.	1.19	1.94	1.77	2.40	2.35	2.99	2.97	4.24	2.94	4.22	4.86
Strength Reduction Factor — Concrete Breakout Failure	ϕ_{cb}	—	0.70[3]										
Concrete Pryout Strength in Shear													
Coefficient for Pryout Strength	k_{cp}	lb.	1.0					2.0					
Strength Reduction Factor — Concrete Pryout Failure	ϕ_{cp}	—	0.70[4]										
Steel Strength in Shear for Seismic Applications													
Shear Resistance for Seismic Loads	V_{eq}	lb.	1,695		2,855		4,790		8,000		9,350		
Strength Reduction Factor — Steel Failure	ϕ_{eq}	—	0.60[2]										

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 and ACI 318-11 Appendix D, except as modified below.
2. The tabulated value of ϕ_{sa} and ϕ_{eq} applies when the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{sa} and ϕ_{eq} must be determined in accordance with ACI 318 D.4.4.
3. The tabulated value of ϕ_{cb} applies when both the load combinations of Section 1605.2.1 of the IBC, ACI 318-14 Section 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. Condition B applies where supplementary reinforcement is not provided. For installations where complying supplementary reinforcement can be verified, the ϕ_{cb} factors described in ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition A are allowed. If the load combinations of ACI 318-11 Appendix C are used, the appropriate value of ϕ_{cb} must be determined in accordance with ACI 318-11 D.4.4(c).
4. The tabulated value of ϕ_{cp} applies when both the load combinations of IBC Section 1605.2, ACI 318-14 5.3 or ACI 318-11 Section 9.2 are used and the requirements of ACI 318-14 17.3.3(c) or ACI 318-11 D.4.3(c) for Condition B are met. If the load combinations of ACI 318-11 Appendix C are used, appropriate value of ϕ_{cp} must be determined in accordance with ACI 318-11 Section D.4.4(c).

Titen HD Tension and Shear Strength Design Data for the Soffit of Normal-Weight or Sand-Lightweight Concrete over Steel Deck[1,6,7]

Characteristic	Symbol	Units	Nominal Anchor Diameter, d_a (in.)									
			Lower Flute						Upper Flute			
			Figure 2		Figure 1				Figure 2		Figure 1	
			¼		⅜		½		¼		⅜	½
Nominal Embedment Depth	h_{nom}	in.	1⅝	2½	1⅞	2½	2	3½	1⅝	2½	1⅞	2
Effective Embedment Depth	h_{ef}	in.	1.19	1.94	1.23	1.77	1.29	2.56	1.19	1.94	1.23	1.29
Pullout Resistance, concrete on steel deck (cracked)[2,3,4]	$N_{p,deck,cr}$	lb.	420	535	375	870	905	2,040	655	1,195	500	1,700
Pullout Resistance, concrete on steel deck (uncracked)[2,3,4]	$N_{p,deck,uncr}$	lb.	995	1,275	825	1,905	1,295	2,910	1,555	2,850	1,095	2,430
Steel Strength in Shear, concrete on steel deck[5]	$V_{sa,\,deck}$	lb.	1,335	1,745	2,240	2,395	2,435	4,430	2,010	2,420	4,180	7,145
Steel Strength in Shear, Seismic	$V_{sa,\,deck,eq}$	lb.	870	1,135	1,434	1,533	1,565	2,846	1,305	1,575	2,676	4,591

1. The information presented in this table is to be used in conjunction with the design criteria of ACI 318-14 Chapter 17 and ACI 318-11 Appendix D, except as modified below.
2. Concrete compressive strength shall be 3,000 psi minimum. The characteristic pullout resistance for greater compressive strengths shall be increased by multiplying the tabular value by $(f'_{c,specified}/3{,}000)^{0.5}$.
3. For anchors installed in the soffit of sand-lightweight or normal-weight concrete over steel deck floor and roof assemblies, as shown in Figure 1 and Figure 2, calculation of the concrete breakout strength may be omitted.
4. In accordance with ACI 318-14 Section 17.4.3.2 or ACI 318-11 Section D.5.3.2, the nominal pullout strength in cracked concrete for anchors installed in the soffit of sand-lightweight or normal-weight concrete over steel deck floor and roof assemblies $N_{p,deck,cr}$ shall be substituted for $N_{p,cr}$. Where analysis indicates no cracking at service loads, the normal pullout strength in uncracked concrete $N_{p,deck,uncr}$ shall be substituted for $N_{p,uncr}$.
5. In accordance with ACI 318-14 Section 17.5.1.2(C) or ACI 318-11 Section D.6.1.2(c), the shear strength for anchors installed in the soffit of sand-lightweight or normal-weight concrete over steel deck floor and roof assemblies $V_{sa,deck}$ and $V_{sa,deck,eq}$ shall be substituted for V_{sa}.
6. Minimum edge distance to edge of panel is $2h_{ef}$.
7. The minimum anchor spacing along the flute must be the greater of $3h_{ef}$, or 1.5 times the flute width.

* See p. 12 for an explanation of the load table icons.

Titen HD® Design Information — Concrete

Titen HD Anchor Tension and Shear Strength Design Data in the Topside of Normal-Weight Concrete or Sand-Lightweight Concrete over Steel Deck

IBC *

Design Information	Symbol	Units	Nominal Anchor Diameter, d_a (in.)	
			Figure 3	Figure 3
			¼	⅜
Nominal Embedment Depth	h_{nom}	in.	1⅝	2½
Effective Embedment Depth	h_{ef}	in.	1.19	1.77
Minimum Concrete Thickness	$h_{min,deck}$	in.	2½	3¼
Critical Edge Distance	$c_{ac,deck,top}$	in.	3¾	7¼
Minimum Edge Distance	$c_{min,deck,top}$	in.	3½	3
Minimum Spacing	$s_{min,deck,top}$	in.	3½	3

1. For anchors installed in the topside of concrete-filled deck assemblies, as shown in Figures 2 and 3, the nominal concrete breakout strength of a single anchor or group of anchors in shear, V_{cb} or V_{cbg}, respectively, must be calculated in accordance with ACI 318-14 Section 17.5.2 or ACI 318-11 Section D.6.2, using the actual member thickness, $h_{min,deck}$, in the determination of A_{Vc}.
2. Design capacity shall be based on calculations according to values in the tables featured on p. 84.
3. Minimum flute depth (distance from top of flute to bottom of flute) is 1½" (see Figures 2 and 3).
4. Steel deck thickness shall be minimum 20 gauge.
5. Minimum concrete thickness ($h_{min,deck}$) refers to concrete thickness above upper flute (see Figures 2 and 3).

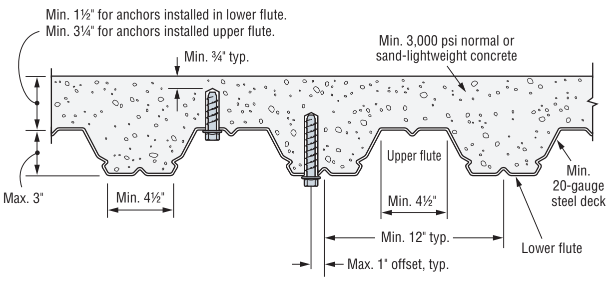


Figure 1. Installation of ⅜"- and ½"-Diameter Anchors in the Soffit of Concrete over Steel Deck

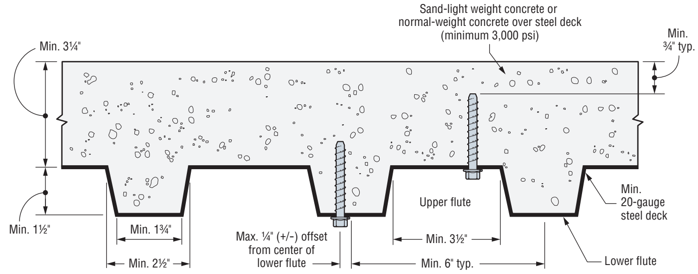


Figure 2. Installation of ¼"-Diameter Anchors in the Soffit of Concrete over Steel Deck

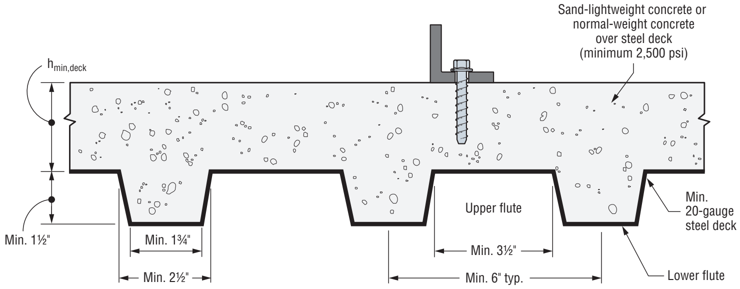
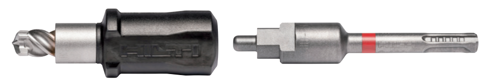


Figure 3. Installation of ¼"- and ⅜"-Diameter Anchors in the Topside of Concrete over Steel Deck

* See p. 12 for an explanation of the load table icons.

PRODUCT DESCRIPTION

Carbon steel HDI-P TZ

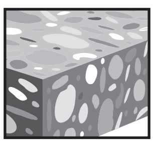


Auto-setting tool HDI-P TZ

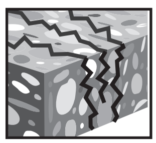
Hand-setting tool HDI-P TZ

Product Features

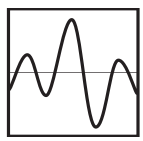
- Flush anchor with optimized length for reliable fastenings in post-tensioned cable concrete slabs
- Shallow drilling for fast installations
- Lip provides flush installation, consistent anchor depth, and easy rod alignment
- Suitable for uncracked and cracked concrete including seismic areas
- Productive installation with HDI-P TZ automatic setting tool with hammer drill
- Used with Hilti Dust Removal System (DRS) for compliance with Table 1 of OSHA 1926.1153 regulations for silica dust exposure



Uncracked concrete



Cracked concrete



Seismic Design Categories A-F

Approvals/ Listings	
ICC-ES (International Code Council) - 2018 International Building Code / International Residential Code (IBC/IRC)	ESR-4236 in concrete per ACI 318-14 Ch. 17 / ACI 355.2 / ICC-ES AC193
City of Los Angeles	2017 LABC Supplement (within ESR-4236)
Florida Building Code	2017 FBC Supplement (within ESR-4236)
FM (Factory Mutual)	Pipe hanger components for automatic sprinkler systems 3/8 (4-inch nominal pipe diameter)
UL and cUL (Underwriters Laboratory)	Pipe hanger equipment for fire protection services for 3/8 (4-inch nominal pipe diameter)

MATERIAL SPECIFICATIONS

HDI-P TZ flush anchors are manufactured from carbon steel with zinc plating per DIN EN ISO 4042 A2K.

INSTALLATION PARAMETERS

Figure 1 - Hilti HDI-P TZ installation parameters

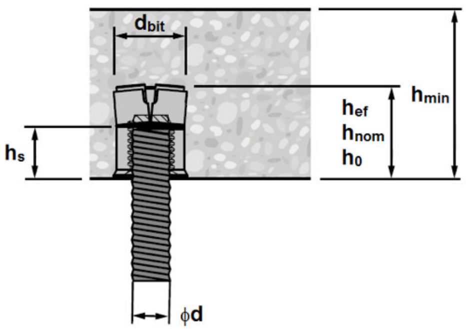


Table 1 - Hilti HDI-P TZ Setting Information

Setting information	Symbol	Unit	Nominal anchor size / internal thread dia. (in)
			3/8
Internal thread diameter	d	in.	3/8
Nominal bit diameter	d_{bit}	in.	9/16
Nominal embedment	h_{nom}	in. (mm)	3/4 (19)
Hole depth in concrete	h_0	in. (mm)	3/4 (19)
Minimum concrete thickness	h_{min}	in. (mm)	2-1/2 (64)
Thread engagement length	h_s	in. (mm)	3/8 (10)
Minimum edge distance	c_{min}	in. (mm)	6 (153)
Minimum anchor spacing	s_{min}	in. (mm)	8 (204)

Installation Instructions

Installation Instructions For Use (IFU) are included with each product package. They can also be viewed or downloaded online at www.hilti.com or www.hilti.ca. Because of the possibility of changes, always verify that downloaded IFU are current when used. Proper installation is critical to achieve full performance. Training is available on request. Contact Hilti Technical Services for applications and conditions not addressed in the IFU.

DESIGN DATA IN CONCRETE PER ACI 318

ACI 318-14 Chapter 17 Design

The design tables in Tables 2 to 4 are Hilti Simplified Design Tables. The load values were developed using the design parameters and variables of ICC Evaluation Services ESR-4236 and the equations within ACI 318-14 Chapter 17 as amended by ICC-ES AC193. The strength design capacities calculated from the tables below are to be compared to the factored loads determined from strength design load combinations. For a detailed explanation of the Hilti Simplified Design Tables, refer to Section 3.1.8 of the Hilti North American Product Technical Guide Volume 2 - Anchor Fastening Ed. 17 [Anchor Tech Guide Ed. 17]. Data tables from ESR-4236 are not contained in this section, but can be found at www.hilti.com or www.icc-es.org.

Table 2 - Hilti HDI-P TZ design strength based on concrete failure modes in uncracked concrete per ACI 318 14 Ch. 17[1,2,3,4,5]

Nominal anchor diameter in.	Nominal embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - φN_n				Shear (lesser of concrete breakout or pryout) - φV_n			
		f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)
3/8	3/4 (19)	310 (1.4)	340 (1.5)	395 (1.8)	485 (2.1)	350 (1.6)	385 (1.7)	445 (2.0)	545 (2.4)

Table 3 - Hilti HDI-P TZ design strength based on concrete failure modes in cracked concrete per ACI 318 14 Ch. 17[1,2,3,4,5,6,7]

Nominal anchor diameter in.	Nominal embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - φN_n				Shear (lesser of concrete breakout or pryout) - φV_n			
		f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)	f'_c = 2500 psi (17.2 MPa) lb (kN)	f'_c = 3000 psi (20.7 MPa) lb (kN)	f'_c = 4000 psi (27.6 MPa) lb (kN)	f'_c = 6000 psi (41.4 MPa) lb (kN)
3/8	3/4 (19)	190 (0.8)	200 (0.9)	220 (1.0)	255 (1.1)	250 (1.1)	270 (1.2)	315 (1.4)	385 (1.7)

The following footnotes apply to both Table 2 and 3:

1 See Section 3.1.8.6 of the Anchor Tech Guide Ed. 17 to convert design strength value to ASD value.
2 Linear interpolation between concrete compressive strengths is not permitted.
3 Tabular values are for a single anchor with a minimum edge distance of 6-1/2-in (166mm) and a minimum spacing of 8-in (204mm). For a 6-in (153mm) edge distance multiply uncracked concrete tension and shear values by 0.92. No reduction needed for cracked concrete.
4 Compare to the steel values in Table 4. The lesser of the values is to be used for the design.
5 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, λ_a = 0.68. For all-lightweight, λ_a = 0.60.
6 Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.74.
7 No additional reduction needed for seismic shear for concrete breakout or pryout failure. See Section 3.1.8.7 of the Anchor Tech Guide Ed. 17 for additional information on seismic applications.

Table 4 - Hilti HDI-P TZ design strength based on steel failure per ACI 318-14 Ch. 17 [1,2,3]

Nominal anchor diameter in.	Steel strength of HDI-P TZ anchor			Steel strength of ASTM A36 threaded rod		
	Tensile[4] φN_{sa} lb (kN)	Shear[5] φV_{sa} lb (kN)	Seismic Shear[6,9] φV_{sa} lb (kN)	Tensile[4] $\varphi N_{sa,rod}$ lb (kN)	Shear[7] $\varphi V_{sa,rod}$ lb (kN)	Seismic Shear[8,9] $\varphi V_{sa,rod,eq}$ lb (kN)
3/8	4,065 (18.1)	585 (2.6)	585 (2.6)	3,370 (15.0)	1,885 (8.4)	1,320 (5.9)

1 See Section 3.1.8.6 of the Anchor Tech Guide Ed. 17 to convert design strength value to ASD value.
2 Steel strength in tension and shear determined from the lesser of the HDI-P TZ or the inserted threaded rod.
3 Hilti HDI-P TZ anchors are considered a brittle steel element. ASTM A36 threaded rod is considered a ductile steel element.
4 Tensile $\varphi N_{sa} = \varphi A_{se,N} f_{uta}$ as noted in ACI 318-14 Ch. 17.
5 Shear values for HDI-P TZ determined by static shear tests with $\varphi V_{sa} \leq \varphi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318-14 Ch. 17.
6 Seismic shear values for HDI-P TZ determined by seismic shear tests with $\varphi V_{sa} < \varphi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318-14 Ch. 17.
7 Shear values for threaded rod determined by $\varphi V_{sa,rod} = \varphi\ 0.60\ A_{se,V} f_{uta}$ as noted in ACI 318-14 Ch. 17.
8 Seismic shear values for threaded rod determined by $\varphi V_{sa,rod,eq} = \varphi\ 0.70\ V_{sa,rod}$.
9 See Section 3.1.8.7 of the Anchor Tech Guide Ed. 17 for additional information on seismic applications.

DESIGN DATA IN CONCRETE PER CSA A23.3

CSA A23.3-14 Annex D Design

Limit State Design of anchors is described in the provisions of CSA A23.3-14 Annex D for post-installed anchors tested and assessed in accordance with ACI 355.2 for mechanical anchors and ACI 355.4 for adhesive anchors. Tables 8 and 9 in this section contains the Limit State Design tables that are based on the published loads in ICC Evaluation Services ESR-4236 and converted for use with CSA A23.3-14 Annex D. Tables 5 to 7 below are Hilti Simplified Design Tables which are pre-factored resistance tables based on the design parameters and variables in Tables 8 and 9. All the figures in the previous ACI 318 14 Chapter 17 design section are applicable to Limit State Design and the tables will reference these figures.

For a detailed explanation of the tables developed in accordance with CSA A23.3-14 Annex D, refer to Section 3.1.8 of the Hilti North American Product Technical Guide Volume 2 - Anchor Fastening Ed. 17 [Anchor Tech Guide Ed. 17]. Technical assistance is available by contacting Hilti Canada at (800) 363-4458 or at www.hilti.ca.

Table 5 - Hilti HDI-P TZ factored resistance based on concrete failure modes in uncracked concrete per CSA A23.3-14 Annex D [1,2,3,4,5]

Nominal anchor diameter in.	Nominal embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - N_r				Shear (lesser of concrete breakout or pryout) - V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
3/8	3/4 (19)	325 (1.5)	365 (1.6)	400 (1.8)	460 (2.1)	380 (1.7)	425 (1.9)	465 (2.1)	540 (2.4)

Table 6 - Hilti HDI-P TZ factored resistance based on concrete failure modes in cracked concrete per CSA A23.3-14 Annex D [1,2,3,4,5,6,7]

Nominal anchor diameter in.	Nominal embed. in. (mm)	Tension (lesser of concrete breakout / pullout) - N_r				Shear (lesser of concrete breakout or pryout) - V_r			
		f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)	f'_c = 20 MPa (2,900 psi) lb (kN)	f'_c = 25 MPa (3,625 psi) lb (kN)	f'_c = 30 MPa (4,350 psi) lb (kN)	f'_c = 40 MPa (5,800 psi) lb (kN)
3/8	3/4 (19)	195 (0.9)	210 (0.9)	220 (1.0)	245 (1.1)	270 (1.2)	300 (1.3)	330 (1.5)	380 (1.7)

The following footnotes apply to both Table 5 and 6:

1 See Section 3.1.8.6 of the Anchor Tech Guide Ed. 17 to convert design strength value to ASD value.
2 Linear interpolation between concrete compressive strengths is not permitted.
3 Tabular values are for a single anchor with a minimum edge distance of 6-1/2-in (166mm) and a minimum spacing of 8-in (204mm). For a 6-in (153mm) edge distance multiply uncracked concrete tension and shear values by 0.92. No reduction needed for cracked concrete.
4 Compare to the steel values in Table 7. The lesser of the values is to be used for the design.
5 Tabular values are for normal weight concrete only. For lightweight concrete multiply design strength by λ_a as follows: For sand-lightweight, λ_a = 0.68. For all-lightweight, λ_a = 0.60.
6 Tabular values are for static loads only. For seismic tension loads, multiply cracked concrete tabular values in tension by $\alpha_{N,seis}$ = 0.74.
7 No additional reduction needed for seismic shear for concrete breakout or pryout failure. See Section 3.1.8.7 of the Anchor Tech Guide Ed. 17 for additional information on seismic applications.

Table 7 - Hilti HDI-P TZ factored resistance based on steel failure per CSA A23.3-14 Annex D [1,2,3]

Nominal anchor diameter in.	Steel strength of HDI-P TZ anchor			Steel strength of ASTM A36 threaded rod		
	Tensile[4] N_{sar} lb (kN)	Shear[5] V_{sar} lb (kN)	Seismic Shear[6,9] $V_{sar,eq}$ lb (kN)	Tensile[4] N_{sar} lb (kN)	Shear[7] V_{sar} lb (kN)	Seismic Shear[8,9] $V_{sar,eq}$ lb (kN)
3/8	3,720 (16.5)	540 (2.4)	540 (2.4)	3,055 (13.6)	1,720 (7.7)	1,200 (5.3)

1 See Section 3.1.8.6 of the Anchor Tech Guide Ed. 17 to convert design strength value to ASD value.
2 Steel strength in tension and shear determined from the lesser of the HDI-P TZ or the inserted threaded rod.
3 Hilti HDI-P TZ anchors are considered a brittle steel element. ASTM A36 threaded rod is considered a ductile steel element.
4 Tensile $N_{sar} = A_{se,N}\ \varphi_s\ f_{uta}$ as noted in CSA A23.3-14 Annex D.
5 Shear values for HDI-P TZ determined by static shear tests with $V_{sar} \leq 0.6\ A_{se,V}\ \varphi s\ f_{uta}\ R$ as noted in CSA A23.3-14 Annex D.
6 Seismic shear values for HDI-P TZ determined by seismic shear tests with $V_{sar,eq} \leq 0.60\ A_{se,V}\ \varphi_s\ f_{uta}\ R$ as noted in CSA A23.3-14 Annex D.
7 Shear values for threaded rod determined by $V_{sar} = 0.6\ A_{se,V}\ \varphi_s\ f_{uta}\ R$ as noted in CSA A23.3-14 Annex D.
8 Seismic shear values for threaded rod determined by $V_{sar,rod,eq} = 0.70\ V_{sar,rod}$.
9 See Section 3.1.8.7 of the Anchor Tech Guide Ed. 17 for additional information on seismic applications.

Table 8 - Design information, Hilti HDI-P TZ, in accordance with CSA A23.3-14 [1]

Setting information	Symbol	Unit	Nominal anchor size / internal thread dia. (in)	Ref
			3/8	CSA A23.3-14
Anchor O.D.	d_a	in. (mm)	0.561 (14.25)	
Effective embedment	h_{ef}	in. (mm)	3/4 (19)	
Steel embed. material resistance factor for reinforcement	φ_s	-	0.85	8.4.3
Resistance modification factor for tension, steel failure modes [2,3]	$R_{s,N}$	-	0.70	D.5.3 b)
Min. specified yield strength	f_{ya}	psi (N/mm^2)	70,400 (484)	
Min. specified ultimate strength	f_{uta}	psi (N/mm^2)	88,000 (605)	
Effective-cross sectional steel area in tension	$A_{se,N}$	in^2 (mm^2)	0.071 (45.8)	
Factored steel resistance in tension [4]	N_{sa}	lb (kN)	6,250 (27.8)	D.6.1.2 Eq. D.2
Concrete material resistance factor	φ_c	-	0.65	8.4.2
Anchor category	-	-	1	D.5.3 c)
Resistance modification factor for tension, concrete failure [3]	$R_{c,N}$	-	0.60	
Coeff. for factored conc. breakout resistance, uncracked concrete	$k_{c,uncr}$	in-lb (SI)	24 (10.0)	D.6.2.2
Coeff. for factored conc. breakout resistance, cracked concrete	$k_{c,cr}$	in-lb (SI)	17 (7.1)	D.6.2.2
Modification factor for anchor resistance, tension, uncracked conc. [5]	$\psi_{c,N}$	-	1.0	D.6.2.6
Critical edge distance	c_{ac}	in. (mm)	6 (152)	
Factored pullout resistance in 20 MPa uncracked concrete [6]	$N_{pr,uncr}$	lb (kN)	N/A	D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete [6]	$N_{pr,cr}$	lb (kN)	495 (2.2)	D.6.3.2
Factored pullout resistance in 20 MPa cracked concrete, seismic [6]	$N_{pr,eq}$	lb (kN)	490 (2.2)	D.6.3.2
Resistance modification factor for shear, steel failure modes [2,3]	$R_{s,V}$	-	0.65	D.5.3 b)
Factored steel resistance in shear [7]	V_{sa}	lb (kN)	975 (4.3)	D7.1.2
Factored steel resistance in shear, seismic [7]	$V_{sa,eq}$	lb (kN)	975 (4.3)	
Resistance modification factor for shear, concrete failure modes [3]	$R_{c,V}$	-	0.70	
Coefficient for pryout resistance	k_{cp}	-	1.0	D.7.3

1 Design information is taken from ICC-ES ESR-4236, dated July 2018, table 2, and converted for use with CSA A23.3-14 Annex D.
2 The HDI-P TZ is considered a brittle steel element as defined by CSA A23.3-14 Annex D Section D.2.
3 All values of R are applicable with the load combinations of CSA A23.3-14 Chapter 8. For concrete failure modes, no increase for Condition A is permitted.
4 $N_{sar} = N_{sa}\ \varphi_s\ R_{s,N}$ where N_{sa} tabular value above is precalculated from $A_{se,N}\ f_{uta}$.
5 For all design cases, $\psi_{c,N} = 1.0$. The appropriate effectiveness factor for cracked concrete ($k_{c,cr}$) or uncracked concrete ($k_{c,uncr}$) must be used.
6 For all design cases, $\psi_{c,P} = 1.0$. Tabular value for pullout resistance is for a concrete compressive strength of 20 MPa (2,900 psi). Pullout resistance for concrete compressive strength greater than 20 MPa (2,900 psi) may be increased by multiplying the tabular pullout resistance by $(f'_c / 20)^{0.35}$ for MPa or $(f'_c / 2{,}900)^{0.35}$ for psi. NA (not applicable) denotes that pullout strength does not need to be considered for design.
7 Shear and seismic shear tests are all performed in cracked concrete member per ICC-ES AC193 section 9.4 and 9.6 respectively. Value of $V_{sa(,eq)} < 0.6\ A_{se,V}\ f_{uta}$ for all cases. Multiply V_{sa} tabular value above by $\varphi_s\ R_{s,V}$ to get V_{sar} and $V_{sar,eq}$.

Table 9 - Steel design information for inserted threaded rod, in accordance with CSA A23.3-14 [1]

Setting information	Symbol	Unit	Nominal anchor size / internal thread dia. (in)
			3/8
Nominal rod diameter	d_{rod}	in.	0.375
Steel embed. material resistance factor for reinforcement	φ_s	-	0.85
Resistance modification factor for tension, steel failure modes [2]	$R_{s,N}$	-	0.80
Min. specified ult. strength	f_{uta}	psi (MPa)	58,000 (400)
Rod effective cross-sectional area	$A_{se,rod}$	$in.^2$ (mm^2)	0.0775 (50)
Factored steel resistance in tension ASTM A36 steel material [3]	$N_{sa,rod}$	lb (kN)	4,495 (20.0)
Factored steel resistance in tension, seismic ASTM A36 steel material [3]	$N_{sa,rod,eq}$	lb (kN)	4,495 (20.0)
Resistance modification factor for steel in shear ASTM A36 steel material [2]	$R_{sa,rod,V}$	-	0.75
Factored steel resistance in shear ASTM A36 steel material [4]	$V_{sa,rod}$	lb (kN)	2,695 (12.0)
Factored steel resistance, seismic ASTM A36 steel material [4]	$V_{sa,rod,eq}$	lb (kN)	1,885 (8.4)

1 Values provided for steel element material types, or equivalent, based on minimum specified strengths and calculated in accordance with CSA A23.3 14 Eq. D.2 and Eq. D.30, as applicable.
2 All values of R are applicable with the load combinations of CSA A23.3-14 Chapter 8. Values correspond to a ductile steel element.
3 $N_{sar,rod(eq)} = N_{sa,rod(eq} \varphi_s R_{s,N}$ where $N_{sa,rod(eq)}$ tabular value above is precalculated from $A_{se,rod}$ f_{uta}. N_{sar} shall be the lower of $N_{sar,rod}$ or $N_{sar,HDI\text{-}P\ TZ}$ for static steel strength in tension; for seismic loads, $N_{sar,eq}$ shall be the lower of $N_{sar,rod,eq}$ or $N_{sar,eq}$, HDI-P TZ.
4 $V_{sar,rod(eq)} = V_{sa,rod(eq)} \varphi_s R_{s,V}$ where $V_{sa,rod}$ tabular value above is precalculated from 0.6 $A_{se,rod}$ f_{uta}, and $V_{sa,rod,eq}$ must be taken as 0.7 $V_{sa,rod}$. V_{sar} shall be the lower of $V_{sar,rod}$ or $V_{sar,HDI\text{-}P\ TZ}$ for static steel strength in tension; for seismic loading, $V_{sar,eq}$ shall be the lower of $V_{sar,eq}$,rod or $V_{sar,eq,HDI\text{-}P\ TZ}$.

3.6.1 Self-Drilling Screw Fastener Selection and Design

3.6.1.3 Head Style Selection

HWH (HHWH)
(High) Hex Washer Head : Washer face provides a bearing surface for the driving sockets.

PPH (PPFH)
Phillips Pan (Framing) Head: Conventional head for general applications and provides low profile fastening.

PFH
Phillips Flat Head: Used primarily in wood to countersink and seat flush without splintering the wood.

PWH
Phillips Wafer Head: Large head provides the bearing surface necessary to seat flush in soft materials.

PBH
Phillips Bugle Head: Used primarily for fastening drywall, plywood or insulation board to steel studs.

PTH (MPTH)
(Modified) Phillips Truss Head: Large head and low profile provides surface area needed to attach wire lath to metal stud.

PPCH
Phillips Pancake Conventional Head: Head for general applications and provides low and flat profile.

PFTH
Phillips Flat Truss Head: Lowest profile head available for attaching metal to metal.

PFHUC
Pancake Framing Head Undercut: Used for countersinking where a full head taper would cause stand-off of the screw.

SHWH
Slotted Hex Washer Head: Hex washer head with slot in center to provide additional drive connection.

3.6.1.4 Sealing Criteria

Sealing washer screws offer weather resistant fastenings where moisture or condensation is a factor. The washer helps seal the hole to help prevent moisture from dripping into the fastener threads from the fastened material side, reducing corrosive build-up. As added protection against corrosion, all sealing washer screws come standard with Kwik-Cote coating. The torque control or depth gauge of the electric screwdrivers help ensure that the optimal seal is applied (Reference Section 3.6.1.7).

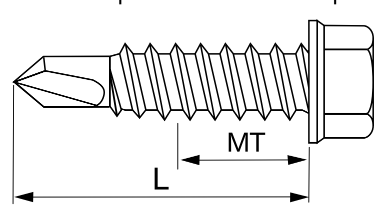
3.6.1.5 Length Selection

Length of the screw (L)

Depending on the screwhead, there are two different ways to measure the overall length of a screw.

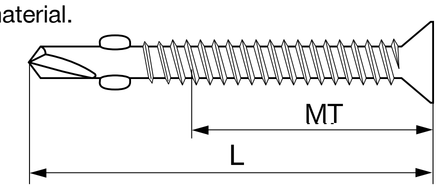
For HWH/HHWH, PPH, PTH, PFTH, SHWH and PPCH screws, the overall length is measured from the bottom of the washer under the head to the point of the screw.

For PWH, PFH, PBH and PFHUC screws, the overall length is measured from the top of the head to the point of the screw.



Maximum Total Thickness (MT)
The maximum total thickness (MT) for all screws is the length of the threads reduced by the first three threads (protruding past the back-side of the base material). See drawings above and below.

The maximum total thickness (MT) describes the maximum thickness of all attachments to be fastened plus the base material.



Self-Drilling Screws 3.6.2

3.6.2.1 Product Description

Hilti self-drilling screws are designed to drill their own hole in steel base materials up to 1/2" thick. These screws are available in a variety of head styles, thread lengths and drill-flute lengths for screw diameters #6 through 1/4". Hilti self-drilling screws meet ASTM C1513, ASTM C954 and SAE J78 standards, as applicable.

Product Features:

- Hex head for metal-to-metal applications
- Flush head for wood-to-metal applications
- For metal from 0.035" to 0.500" thick
- Winged reamers for wood over 1/2" thick
- Stitch screws for light gauge metal-to-metal
- Sealing screws for water resistant fastenings

3.6.2.2 Material Specifications

Material	ASTM A510 Grade 1018-1022
Heat Treatment	Case hardened and tempered • Sizes 8, 10 and 12: 0.004" to 0.009" case depth • Size 1/4": 0.005" to 0.011" case depth
Plating	Refer to Section 3.6.2.5 for screw coating information.

Warning: Because of the potential for delayed hydrogen assisted stress corrosion cracking, many hardened steel fasteners are not recommended for use with dissimilar metals or chemically treated wood when moisture may be present or in corrosive environments. For further information, contact Hilti Technical Support at 1-877-749-6337.

Listings/Approvals

ICC-ES (International Code Council)
ESR-2196

COLA (City of Los Angeles)
RR 25678

ICC-ES ESR-2196, provides IBC recognition of Hilti's Self-Drilling Screw fasteners for most common applications (e.g. CFS connections, gypsum to CFS, etc.), including HWH, HHWH, PPH, PPFH, PBH, PWH, PTH, PPCH, TPCH and PFTH head style screws.

3.6.2.3 Technical Data

Ultimate Tensile Strengths – Pullout (Tension), lb (kN)[1,2,3,4,5,6,7]

Screw Designation	Nominal Diameter in.	Thickness of steel member not in contact with the screw head, ga (in.)					
		20 (0.036)	18 (0.048)	16 (0.060)	14 (0.075)	12 (0.105)	10 (0.135)
#6	0.138	190 (0.85)	250 (1.11)	320 (1.42)	395 (1.76)	555 (2.47)	715 (3.18)
#7	0.151	210 (0.93)	275 (1.22)	345 (1.53)	435 (1.93)	605 (2.69)	780 (3.47)
#8	0.164	225 (1.00)	300 (1.33)	375 (1.67)	470 (2.09)	660 (2.94)	845 (3.76)
#10	0.190	260 (1.16)	350 (1.56)	435 (1.93)	545 (2.42)	765 (3.40)	980 (4.36)
#12	0.216	295 (1.31)	395 (1.76)	495 (2.20)	620 (2.76)	870 (3.87)	1120 (4.98)
1/4 in.	0.250	345 (1.53)	460 (2.05)	575 (2.56)	715 (3.18)	1000 (4.45)	1290 (5.74)

1 The lower of the ultimate pullout, pullover, and tension fastener strength of screw should be used for design.
2 Load values based upon calculations done in accordance with Section E4 of the AISI S100.
3 AISI S100 recommends a safety factor of 3.0 be applied for allowable strength design, a Φ factor of 0.5 be applied for LRFD design or a Φ factor of 0.4 be applied for LSD design.
4 ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.
5 The screw diameters in the table above are available in head styles of pan, hex washer, pancake, flat, wafer and bugle.
6 The load data in the table is based upon sheet steel with F_u = 45 ksi. For F_u = 55 ksi steel, multiply values by 1.22. For F_u = 65 ksi steel, multiply values by 1.44.
7 Refer to Section 3.6.2.5 to ensure drilling capacities.

3.6.2 Self-Drilling Screws

Ultimate Tensile Strengths – Pullover (Tension), lb (kN)[1,2,3,4,5,6,7]

Screw Designation	Washer or Head Diameter in.	Thickness of steel member in contact with the screw head, ga (in.)						
		22 (0.030)	20 (0.036)	18 (0.048)	16 (0.060)	14 (0.075)	12 (0.105)	10 (0.135)
Hex Washer Head (HWH)								
#8	0.335	675 (3.00)	815 (3.63)	1000 (4.45)	1000 (4.45)	1000 (4.45)	1000 (4.45)	1000 (4.45)
#10	0.399	805 (3.58)	970 (4.31)	1290 (5.74)	1370 (6.09)	1370 (6.09)	1370 (6.09)	1370 (6.09)
#12-14	0.415	835 (3.71)	1010 (4.49)	1340 (5.96)	1680 (7.47)	2100 (9.34)	2325 (10.34)	2325 (10.34)
#12-24	0.415	835 (3.71)	1010 (4.49)	1340 (5.96)	1680 (7.47)	2100 (9.34)	2940 (13.08)	3780 (16.81)
1/4 in.	0.500	1010 (4.49)	1220 (5.43)	1620 (7.21)	2030 (9.03)	2530 (11.25)	3540 (13.75)	4560 (20.28)
Phillips Pan Head (PPH)								
#7	0.303	615 (2.74)	735 (3.27)	980 (4.36)	1000 (4.45)	1000 (4.45)	1000 (4.45)	1000 (4.45)
#8	0.311	630 (2.80)	755 (3.36)	1000 (4.45)	1000 (4.45)	1000 (4.45)	1000 (4.45)	1000 (4.45)
#10	0.364	740 (3.29)	885 (3.94)	1180 (5.25)	1370 (6.09)	1370 (6.09)	1370 (6.09)	1370 (6.09)
Phillips Truss Head (PTH)								
#8	0.433	875 (3.89)	1000 (4.45)	1000 (4.45)	1000 (4.45)	1000 (4.45)	1000 (4.45)	1000 (4.45)
#10	0.411	830 (3.69)	1000 (4.45)	1330 (5.92)	1390 (6.18)	1390 (6.18)	1390 (6.18)	1390 (6.18)
Phillips Pancake Head (PPCH)								
#10, #12	0.409	830 (3.69)	995 (4.43)	1325 (5.89)	1370 (6.09)	1370 (6.09)	1370 (6.09)	1370 (6.09)
Phillips Flat Truss Head (PFTH)								
#10	0.364	740 (3.29)	885 (3.94)	1180 (5.25)	1475 (6.56)	1840 (8.18)	2170 (9.65)	2170 (9.65)

1. The lower of the ultimate pullout, pullover, and tension fastener strength of screw should be used for design.
2. Load values based upon calculations done in accordance with Section E4 of the AISI S100.
3. AISI S100 recommends a safety factor of 3.0 be applied for allowable strength design, a Φ factor of 0.5 be applied for LRFD design or a Φ factor of 0.4 be applied for LSD design.
4. ANSI/ASME standard screw head diameters were used in the calculations and are listed in the tables.
5. Phillips Bugle Head (PBH) and Phillips Wafer Head (PWH) styles are not covered by this table because they are not intended for attachment of steel to steel.
6. The load data in the table is based upon sheet steel with F_u = 45 ksi. For F_u = 55 ksi steel, multiply values by 1.22. For F_u = 65 ksi steel, multiply values by 1.44.
7. Refer to Section 3.6.2.5 for drilling capacities.

Nominal Ultimate Fastener Strength of Screw

Screw Designation	Nominal Diameter (in.)	Nominal Fastener Strength			
		Tension, P_{ts} lb (kN)[1]		Shear, P_{ss} lb (kN)[2,3,4]	
#6-20	0.138	1000	(4.45)	890	(3.96)
#7-18	0.151	1000	(4.45)	890	(3.96)
#8-18	0.164	1000	(4.45)	1170	(5.20)
#10-12	0.190	2170	(9.65)	1645	(7.32)
#10-16	0.190	1370	(6.09)	1215	(5.40)
#10-18	0.190	1390	(6.18)	1645	(7.32)
#12-14	0.216	2325	(10.34)	1880	(8.36)
#12-24	0.216	3900	(17.35)	2285	(10.16)
1/4 in.	0.250	4580	(20.37)	2440	(10.85)

1 The lower of the ultimate pullout, pullover, and tension fastener strength of screw should be used for design. The Pullout and Pullover tables in this section have already been adjusted where screw strength governs.

2 The lower of the ultimate shear fastener strength and shear bearing should be used for design. The Shear Bearing table in this section has already been adjusted where screw strength governs.

3 AISI S100 recommends a safety factor of 3.0 be applied for allowable strength design, a Φ factor of 0.5 be applied for LRFD design or a Φ factor of 0.4 be applied for LSD design.

4 When the distance to the end of the connected part is parallel to the line of the applied force the allowable shear fastener strength must be reduced for end distance, when necessary, in accordance with E4.3.2 of Appendix A of AISI S100.

Torsional Strength[1,2]

Size	Min. Torsional Strength in-lb (Nm)	
6-20	24	(2.7)
7-18	38	(4.3)
8-18	42	(4.8)
10-12	61	(6.9)
10-16	61	(6.9)
10-18	61	(6.9)
10-24	65	(7.3)
12-14	92	(10.4)
12-24	100	(11.3)
1/4-14	150	(17.0)
1/4-20	156	(17.6)

1 Based on screw only. Does not consider base material limitations.

2 Values in table are ultimate torsional strengths. To obtain maximum setting torque, multiply values in table by 0.66.

Self-Drilling Screws 3.6.2

Ultimate Shear Strengths – Bearing (Shear), lb (kN)[1,2,3,4,5,6,7]

Screw Designation	Nominal Diameter in.	Thickness of steel member in contact with screw head ga (in.)	Thickness of steel member not in contact with the screw head, ga (in.)				
			20 (0.036)	**18** (0.048)	**16** (0.060)	**14** (0.075)	**≥ 12** (0.105)
#7	**0.151**	**20** (0.036)	**500** (2.22)	**660** (2.94)	**660** (2.94)	**660** (2.94)	**660** (2.94)
		18 (0.048)	**500** (2.22)	**660** (2.94)	**880** (3.91)	**880** (3.91)	**880** (3.91)
		≥ 16 (0.060)	**500** (2.22)	**660** (2.94)	**890** (3.96)	**890** (3.96)	**890** (3.96)
#8	**0.164**	**20** (0.036)	**525** (2.34)	**715** (3.18)	**715** (3.18)	**715** (3.18)	**715** (3.18)
		18 (0.048)	**525** (2.34)	**805** (3.58)	**955** (4.25)	**955** (4.25)	**955** (4.25)
		≥ 16 (0.060)	**525** (2.34)	**805** (3.58)	**1120** (4.98)	**1170** (5.20)	**1170** (5.20)
#10-12	**0.190**	**20** (0.036)	**565** (2.51)	**830** (3.69)	**830** (3.69)	**830** (3.69)	**830** (3.69)
		18 (0.048)	**565** (2.51)	**865** (3.85)	**1110** (4.94)	**1110** (4.94)	**1110** (4.94)
		16 (0.060)	**565** (2.51)	**865** (3.85)	**1210** (5.38)	**1390** (6.18)	**1390** (6.18)
		≥ 14 (0.075)	**565** (2.51)	**865** (3.85)	**1210** (5.38)	**1645** (7.32)	**1645** (7.32)
#10-16	**0.190**	**20** (0.036)	**565** (2.51)	**830** (3.69)	**830** (3.69)	**830** (3.69)	**830** (3.69)
		18 (0.048)	**565** (2.51)	**865** (3.85)	**1110** (4.94)	**1110** (4.94)	**1110** (4.94)
		≥ 16 (0.060)	**565** (2.51)	**865** (3.85)	**1210** (5.38)	**1215** (5.40)	**1215** (5.40)
#10-18	**0.190**	**20** (0.036)	**565** (2.51)	**830** (3.69)	**830** (3.69)	**830** (3.69)	**830** (3.69)
		18 (0.048)	**565** (2.51)	**865** (3.85)	**1110** (4.94)	**1110** (4.94)	**1110** (4.94)
		16 (0.060)	**565** (2.51)	**865** (3.85)	**1210** (5.38)	**1390** (6.18)	**1390** (6.18)
		≥ 14 (0.075)	**565** (2.51)	**865** (3.85)	**1210** (5.38)	**1645** (7.32)	**1645** (7.32)
#12-14	**0.216**	**20** (0.036)	**600** (2.67)	**930** (4.14)	**945** (4.20)	**945** (4.20)	**945** (4.20)
		18 (0.048)	**600** (2.67)	**925** (4.11)	**1260** (5.60)	**1260** (5.60)	**1260** (5.60)
		16 (0.060)	**600** (2.67)	**925** (4.11)	**1290** (5.74)	**1570** (6.98)	**1570** (6.98)
		≥ 14 (0.075)	**600** (2.67)	**925** (4.11)	**1290** (5.74)	**1800** (8.00)	**1880** (8.36)
#12-24	**0.216**	**20** (0.036)	**600** (2.67)	**930** (4.14)	**945** (4.20)	**945** (4.20)	**945** (4.20)
		18 (0.048)	**600** (2.67)	**925** (4.11)	**1260** (5.60)	**1260** (5.60)	**1260** (5.60)
		16 (0.060)	**600** (2.67)	**925** (4.11)	**1290** (5.74)	**1570** (6.98)	**1570** (6.98)
		14 (0.075)	**600** (2.67)	**925** (4.11)	**1290** (5.74)	**1800** (8.00)	**1970** (8.76)
		≥ 12 (0.090)	**600** (2.67)	**925** (4.11)	**1290** (5.74)	**1800** (8.00)	**2285** (10.16)
1/4 in.	**0.250**	**20** (0.036)	**645** (2.87)	**1020** (4.54)	**1090** (4.85)	**1090** (4.85)	**1090** (4.85)
		18 (0.048)	**645** (2.87)	**995** (4.43)	**1400** (6.23)	**1460** (6.49)	**1460** (6.49)
		16 (0.060)	**645** (2.87)	**995** (4.43)	**1390** (6.18)	**1820** (8.10)	**1820** (8.10)
		14 (0.075)	**645** (2.87)	**995** (4.43)	**1390** (6.18)	**1940** (8.63)	**2280** (10.14)
		≥ 12 (0.090)	**645** (2.87)	**995** (4.43)	**1390** (6.18)	**1940** (8.63)	**2440** (10.85)

1 The lower of the ultimate shear bearing and shear fastener strength of screw should be used for design.

2 Load values based upon calculations done in accordance with Section E4 of AISI S100.

3 AISI S100 recommends a safety factor of 3.0 be applied for allowable strength design, a Φ factor of 0.5 be applied for LRFD design or a Φ factor of 0.4 be applied for LSD design.

4 ANSI/ASME standard screw diameters were used in the calculations and are listed in the tables.

5 Load values in table are for Hex Washer Head (HWH and HHWH), Phillips Pan Head (PPH), Phillips Truss Head (PTH), Phillips Pancake Head (PPCH), and Phillips Flat Truss Head (PFTH) style screws. Phillips Bugle Head (PBH) and Phillips Wafer Head (PWH) styles are not covered by this table because they are not intended for attachment of steel to steel.

6 The load data in the table is based upon sheet steel with F_u = 45 ksi. For F_u = 55 ksi steel, multiply values by 1.22. For F_u = 65 ksi steel, multiply values by 1.44.

7 Refer to Section 3.6.2.5 to ensure drilling capacities.

3.6.2.4 Installation Instructions

For general discussion of Hilti screw fastener installation, reference Section 3.6.1.7.

For allowable diaphragm shear loads and stiffness values for steel roof or floor deck utilizing Hilti self-drilling screws as frame or sidelap fasteners, reference Section 3.5 and download Hilti's Profis DF software at www.us.hilti.com/decking (US), or www.hilti.ca (Canada).

To estimate the number of sidelap screws on a steel roof or floor deck project, reference Section 3.5.1.6.

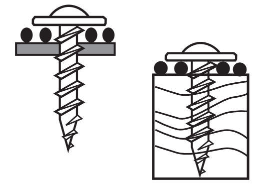
Warning: Because of the potential for delayed hydrogen assisted stress corrosion cracking, many hardened steel fasteners are not recommended for use with dissimilar metals or chemically treated wood when moisture may be present or in corrosive environments. For further information, contact Hilti Technical Support at 1-877-749-6337.

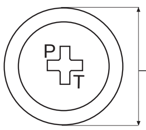
PRIMESOURCE BUILDING PRODUCTS, INC.

SPEC DATA Submittal Sheet # 005

MODIFIED TRUSS HEAD SELF- PIERCING SHEET METAL SCREW

Expanded wire to wood or 25-20 gauge steel

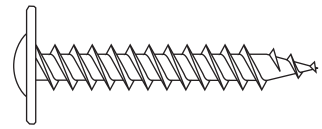




Meets ASTM C-1002

Reduced #2 Phillips

Product Specifications



Part #	Dia.	Length	TPI	Bulk Qty	Finish	Corrosion	Head Diameter	Thread	Point
MT812	8	1/2	15	10M	Zinc	24 hr. min. B-117	10.8mm~ 11.4mm	Double lead	Piercing 25^{o}
MT834	8	3/4	15	8M	Zinc	24 hr. min. B-117	10.8mm~ 11.4mm	Double lead	Piercing 25^{o}
MT100	8	1	15	5M	Zinc	24 hr. min. B-117	10.8mm~ 11.4mm	Double lead	Piercing 25^{o}
MT114	8	1-1/4	15	5M	Zinc	24 hr. min. B-117	10.8mm~ 11.4mm	Double lead	Piercing 25^{o}
MT158	8	1-5/8	15	5M	Zinc	24 hr. min. B-117	10.8mm~ 11.4mm	Double lead	Piercing 25^{o}
MT178	8	1-7/8	15	4M	Zinc	24 hr. min. B-117	10.8mm~ 11.4mm	Double lead	Piercing 25^{o}
MT200	8	2	15	2.5M	Zinc	24 hr. min. B-117	10.8mm~ 11.4mm	Double lead	Piercing 25^{o}
MT212	8	2-1/2	15	2M	Zinc	24 hr. min. B-117	10.8mm~ 11.4mm	Double lead	Piercing 25^{o}
MT300	8	3	15	1.5M	Zinc	24 hr. min. B-117	10.8mm~ 11.4mm	Double lead	Piercing 25^{o}

Pro-Twist sheet metal screws meet or exceed ASTM C-1002 and/or ASTM C-1513

Self Piercing Screws Ultimate Value Chart				
Dia.	Metal Gauge/1lb	Tension (Pull) Lbs. 1 Pc.	Shear Lbs. Metal to Metal	Minimum Torsional Strength (Lb)
8	25	149	337	39
	22	196	591	
	20	574	829	

Self Piercing Screws Ultimate Value Chart		
Dia.	Wood	Withdrawal Value (Pull out)
8	redwood	206
	3/4" partical board	266
	2x4 fir	398

Ultimate Value Charts
Steel - Screws driven into steel were driven with three exposed threads on the off side of the connection, then pulled out with testing machine.

Wood - Screws driven 3/4" into the wood material, then pulled out the testing machine.

Note that all results were obtained in strict adherence to ASTM test protocol. These ultimate figures are offered only as a guide and are not guaranteed in any way by PrimeSource Building Products. A 4:1 safety ratio is recommended.

Installation Guidelines
0-2500rpm Screwgun with torque adjustment - Overdriving may result in fastener failure or stripout of the work surface

The fastener is fully seated when the head's bearing surface is flush with the steel.
The fastener must penetrate beyond the metal a minimum of three threads to comply with the code

NOT Recommended for use with treated wood.

ALL PRIMESOURCE FASTENERS ARE MANUFACTURED IN AN ISO 9002 AND ISO 14001 CERTIFIED AND APPROVED FACTORY TO PRIMESOURCE PERFORMANCE SPECIFICATIONS AND PRINT DRAWINGS.

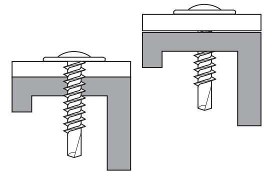
PRIMESOURCE BUILDING PRODUCTS, INC.

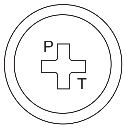
SPEC DATA Submittal Sheet # 007

MODIFIED TRUSS HEAD SELF-DRILL SCREW

The *“old standard”* head design for the attachment of metal lath and steel framing

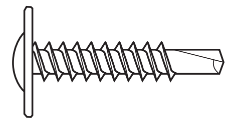
ES ESR 1408





#2 Reduced Phillips

Product Specifications



Part #	Dia.	Length	TPI	Bulk Qty	Finish	Corrosion	Thread	Head Dia.	Drill Capacity
MTD812	8	1/2	18	10M	Zinc	24 hr. min. B-117	FULL	10.8-11.4mm	.033”-.100“
MTD834	8	3/4	18	10M	Zinc	24 hr. min. B-117	FULL	10.8-11.4mm	.033”-.100“
MTD8100	8	1	18	8M	Zinc	24 hr. min. B-117	FULL	10.8-11.4mm	.033”-.100“
MTD8114	8	1-1/4	18	6M	Zinc	24 hr. min. B-117	FULL	10.8-11.4mm	.033”-.100“
MTD8158	8	1-5/8	18	5M	Zinc	24 hr. min. B-117	FULL	10.8-11.4mm	.033”-.100“
MTD8178	8	1-7/8	18	3M	Zinc	24 hr. min. B-117	FULL	10.8-11.4mm	.033”-.100“
MTD8200	8	2	18	2.5M	Zinc	24 hr. min. B-117	FULL	10.8-11.4mm	.033”-.100“
MTD8212	8	2-1/2	18	2M	Zinc	24 hr. min. B-117	FULL	10.8-11.4mm	.033”-.100“
MTD8300	8	3	18	1.5M	Zinc	24 hr. min. B-117	FULL	10.8-11.4mm	.033”-.100“
MTD1034	10	3/4	16	5M	Zinc	24 hr. min. B-117	FULL	10.8-11.4mm	.110”-.175“

Pro-Twist drill screws meet or exceed ASTM C-954 and/or C-1513

Self-Drilling Screws Ultimate Connection Value Chart

Dia.	Metal Gauge/1lb	Tension (Pull) Lbs. 1 Pc.	Shear Lbs. Metal to Metal	Torsional Strength
8	20	285	829	42 lbs.
	18	444	994	
	16	550	1096	
	14	924	1332	
	12	1100	1337	
10	20	389	811	61 lbs.
	18	554	1223	
	16	727	1492	
	14	1050	1545	
	12	1216	1650	

Ultimate Value Charts
Screws driven into steel were driven with three exposed threads on the off side of the connection, then pulled out with testing machine.

Note that all results were obtained in strict adherence to ASTM test protocol. These ultimate figures are offered only as a guide and are not guaranteed in any way by PrimeSource Building Products. A 3:1 safety ratio is recommended.

Installation Guidelines
0-2500rpm Screwgun with torque adjustment - Overdriving may result in fastener failure or stripout of the work surface
The fastener is fully seated when the head’s bearing surface is flush with the steel.
The fastener must penetrate beyond the metal a minimum of three threads to comply with the code.

ALL PRIMESOURCE FASTENERS ARE MANUFACTURED IN AN ISO 9002 AND ISO 14001 CERTIFIED AND APPROVED FACTORY TO PRIMESOURCE PERFORMANCE SPECIFICATIONS AND PRINT DRAWINGS.

3.2.5 GENERAL APPLICATION FASTENERS

3.2.5.1 PRODUCT DESCRIPTION

X-U* Universal Series This universal high performance fastener is designed for applications in concrete and high strength or standard strength steel. The shank diameter is consistent through the fastener offering at 0.157". X-U fastener lengths range from 5/8" through 2-7/8" and are available as single fasteners (P8) or collated (MX) in strips of 10. All X-U fasteners have a unique twist knurling reaching 7/8" from the tip up the shank.

X-P* Premium Concrete Fastener The X-P fastener is optimized for high performance in concrete base materials. With a shank diameter of 0.157", an optimized conical tip design, and high steel hardness, the X-P is designed for demanding concrete applications, in base materials up to 8,000 psi in strength. The X-P fastener is available in lengths ranging from 5/8" to 1 9/16", making it ideal for drywall track to concrete applications. X-P fasteners are available as single fasteners (P8) or collated (MX) in strips of 10.

X-C Standard Series The X-C series of fasteners is a cost effective solution for applications in concrete and masonry. This fastener is not suited for fastening to steel base materials. Fastener lengths range from 3/4" through 2-7/8" with a shank diameter of 0.138". X-C fasteners are offered in a single (P8) fastener version as well as in collated (MX) strips of 10.

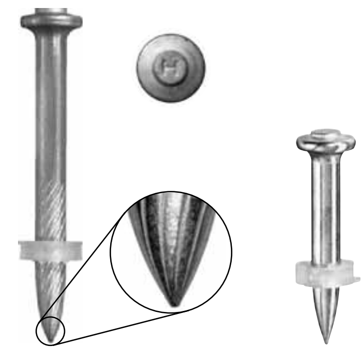
X-CR and X-R Fastener Series The X-CR is a high performance, corrosion resistant fastener equivalent to SAE 316 stainless steel. This fastener is ideally suited for applications where corrosion is a concern whether on concrete or steel base materials. The X-CR is designed mainly for concrete applications and is offered as a single (P8) fastener in lengths from 5/8" through 2-1/8". The X-R fastener is intended for steel applications and is offered in 1/2" shank length. Shank diameter for these fasteners is 0.145" for shank lengths less than 1-1/2" and 0.157" for longer fasteners.

X-S Steel Fastener The X-S is an economical fastener for steel. It has a 0.145" smooth shank diameter and is offered in a 1/2" and 5/8" length. The X-S13 comes collated (MX) in strips of 10 or individually with a plastic "tophat" (THP). The X-S16 comes singly with a metal "tophat" (TH). This fastener is ideally suited for fastening drywall track to standard strength steel and is discussed further in Section 3.2.6.

X-C G2/G3/B3, X-P G2/G3/B3, X-PN G3, X-S B3 These collated fastener lines for Hilti's gas-actuated and battery actuated tools are designed for applications in interior finishing, mechanical and electrical trades. These fasteners are used for fastenings in concrete and masonry (X-C G2/G3/B3 standard, X-P G2/G3/B3 premium), and steel (X-S B3 and X-P G2/G3). For more details refer to Section 3.2.6.

DS/EDS Fastener Series The DS series fastener is a high performance fastener of 0.177" shank diameter suitable for both concrete and steel applications. It is offered in a single fastener version only with a 10 mm dome head design and a 10 mm guidance washer. Available lengths are 3/4" through 2-1/2". Knurling is offered on 3/4" and 7/8" lengths; designated as EDS and ideally suited for steel applications.

X-U 15 Steel Fastener The X-U 15 is a premium, high performance fastener designed specifically for attachments to steel (e.g. drywall track, tagging, etc.). It is offered in a 0.145" shank diameter and 5/8" length with a unique step shank design as either single fasteners with metal tophat or collated in strips of 10.



X-U X-P

X-C DS X-CR, X-R

X-S EDS X-U 15

Listings/Approvals

ICC-ES (International Code Council)
ESR-2269 (X-P, X-U and X-U 15)
ESR-1663 (DS, EDS, X-R and X-CR)
ESR-1752 with 2017 LABC/LARC Supplement (X-C, X-P G2/G3/B3, X-S)

COLA (City of Los Angeles)
RR 25675 (X-P, X-U and X-U 15)
RR 25646 (DS, X-C, EDS, and X-CR)

3.2.5.2 MATERIAL SPECIFICATIONS

Fastener designation	Fastener material	Fastener plating[1]	Steel washer or clip plating[1,2]	Washer or clip plating[1,2]
X-P*	Carbon Steel	5 µm Zinc	N/A	N/A
X-U*	Carbon Steel	5 µm Zinc	Carbon Steel	5 µm Zinc
DS/EDS	Carbon Steel	5 µm Zinc	N/A	N/A
X-C	Carbon Steel	5 µm Zinc	Carbon Steel	5 µm Zinc
X-R, X-CR[3]	SAE 316	N/A	SAE 316	N/A
X-C/ X-P/ X-PN/ X-S: G2/G3/B3	Carbon Steel	2-10 µm Zinc	N/A	N/A
X-CT Forming Nail	Carbon Steel	5 µm Zinc	N/A	N/A
BC X-C	Carbon Steel	5 µm Zinc	Carbon Steel	5 µm Zinc

1 The 5 µm zinc coating is in accordance with ASTM B 633, SC 1, Type III. Refer to Section 2.3.3.1 for more information.

2 Most fasteners have a plastic washer for guidance when installing. Not all fastener lengths have a pre-mounted steel washer. Refer to Section 3.2.2.4 for more information on available fasteners.

3. The X-CR and X-R fastener material is a proprietary material, which provides a corrosion resistance equivalent to SAE 316 stainless steel. The steel washer material is SAE 316 stainless steel.

* More details about the innovative X-P and X-U fasteners can be found in Section 3.2.6.

3.2.5.3 TECHNICAL DATA

Allowable loads in normal weight concrete [1,2]

Fastener description	Fastener	Shank diameter in. (mm)	Minimum embedment in. (mm)	Concrete compressive strength							
				2000 psi		4000 psi		6000 psi		8000 psi	
				Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear lb (kN)
Premium Concrete Fastener	X-P	**0.157** (4.0)	**3/4** (19)	**100** (0.44)	**155** (0.69)	**100** (0.44)	**175** (0.78)	**105** (0.47)	**205** (0.91)	**135** (0.60)	**205** (0.91)
			1 (25)	**165** (0.73)	**220** (0.98)	**180** (0.80)	**225** (1.00)	**150** (0.67)	**300** (1.33)	**150** (0.67)	**215** (0.96)
			1-1/4 (32)	**240** (1.07)	**310** (1.38)	**280** (1.25)	**310** (1.38)	**180** (0.80)	**425** (1.89)	–	–
			1-1/2 (38)	**310** (1.38)	**420** (1.87)	–	–	–	–	–	–
Universal Knurled Shank Fasteners	X-U	**0.157** (4.0)	**3/4** (19)	**100** (0.44)	**125** (0.57)	**100** (0.44)	**125** (0.57)	**105** (0.47)	**205** (0.91)	–	–
			1 (25)	**165** (0.73)	**190** (0.85)	**170** (0.76)	**225** (1.00)	**110** (0.49)	**280** (1.25)	–	–
			1-1/4 (32)	**240** (1.07)	**310** (1.38)	**280** (1.25)	**310** (1.38)	**180** (0.80)	**425** (1.89)	–	–
			1-1/2 (38)	**275** (1.22)	**420** (1.87)	**325** (1.45)	**420** (1.87)	–	–	–	–
Standard Fastener	X-C (Black collated strip or guidance washer)	**0.138** (3.5)	**3/4** (19)	**45** (0.20)	**75** (0.33)	**65** (0.29)	**105** (0.47)	**95** (0.42)	**195** (0.87)	–	–
			1 (25)	**85** (0.38)	**150** (0.67)	**160** (0.71)	**200** (0.89)	**105** (0.47)	**270** (1.20)	–	–
			1-1/4 (32)	**130** (0.58)	**210** (0.93)	**270** (1.20)	**290** (1.29)	**165** (0.73)	**325** (1.45)	–	–
			1-1/2 (38)	**175** (0.78)	**260** (1.16)	**270** (1.20)	**360** (1.60)	–	–	–	–
Heavy Duty Fastener	DS	**0.177** (4.5)	**3/4** (19)	**50** (0.22)	**120** (0.53)	**125** (0.56)	**135** (0.60)	–	–	–	–
			1 (25)	**130** (0.58)	**195** (0.87)	**155** (0.69)	**240** (1.07)	–	–	–	–
			1-1/4 (32)	**220** (0.98)	**385** (1.71)	**270** (1.20)	**425** (1.89)	–	–	–	–
			1-1/2 (38)	**300** (1.33)	**405** (1.80)	**355** (1.58)	**450** (2.00)	–	–	–	–
Stainless Steel Fastener	X-CR	**0.145** (3.7)	**3/4** (19)	**30** (0.13)	**40** (0.18)	**65** (0.29)	**40** (0.18)	–	–	–	–
			1 (25)	**55** (0.24)	**185** (0.82)	**120** (0.53)	**190** (0.85)	**100** (0.44)	**170** (0.76)	–	–
			1-1/4 (32)	**110** (0.49)	**290** (1.29)	**125** (0.56)	**300** (1.33)	**120** (0.53)	**440** (1.96)	–	–
			1-1/2 (38)	**265** (1.18)	**405** (1.80)	**350** (1.56)	**450** (2.00)	–	–	–	–
Gas Fastener	X-C B3, X-C G3	**0.118** (3.0)	**3/4** (19)	**110** (0.5)	**190** (0.9)	**110** (0.5)	**190** (0.9)	**110** (0.5)	**190** (0.9)	–	–
Premium Gas Fastener	X-GHP, X-P 17 G2, X-P 20 G2, X-P G3, X-P B3	**0.118** (3.0)	**5/8** (16)	–	–	**50** (0.2)	**120** (0.5)	**50** (0.2)	**90** (0.4)	–	–
			3/4 (19)	**80** (0.4)	**120** (0.5)	–	–	–	–	–	–
Forming Fastener	X-CT 47[3]	**0.145** (3.7)	**1** (25)	**60** (0.27)	**65** (0.29)	–	–	–	–	–	–
	X-CT 62[3]	**0.145** (3.7)	**1** (25)	**75** (0.33)	**75** (0.33)	–	–	–	–	–	–

1 The tabulated allowable load values are for the low-velocity fasteners only, using a safety factor that is greater than or equal to 5.0, calculated in accordance with ICC-ES AC70. Wood or steel members connected to the substrate must be investigated in accordance with accepted design criteria.

2 Multiple fasteners are recommended for any attachment.

3 For temporary fastening of formwork only.

Allowable loads in minimum f'$_c$ = 3000 psi structural lightweight concrete[1,5]

Fastener description	Fastener	Shank diameter in. (mm)	Minimum embedment in. (mm)	Fastener location					
				Installed into concrete		Installed through 3" deep metal deck into concrete[2,3]			
				Tension lb (kN)	Shear lb (kN)	Tension lb (kN)		Shear lb (kN)	
						Upper flute	Lower flute	Upper flute	Lower flute
Premium Concrete Fastener	X-P*	**0.157** (4.0)	**3/4** (19)	**155** (0.7)	**165** (0.7)	**130** (0.6)	**105** (0.5)	285 (1.3)	285 (1.3)
			1 (25)	**225** (1.0)	**300** (1.3)	**215** (1.0)	**165** (0.7)	340 (1.5)	340 (1.5)
			1-1/4 (32)	**325** (1.4)	**445** (2.0)	**295** (1.3)	**230** (1.0)	375 (1.7)	375 (1.7)
			1-1/2 (38)	**425** (1.9)	**480** (2.1)	**400** (1.8)	**330** (1.5)	365 (1.6)	365 (1.6)
Universal Knurled Shank Fasteners	X-U*	**0.157** (4.0)	**3/4** (19)	**125** (0.56)	**115** (0.51)	**130** (0.58)	**95** (0.42)	245 (1.1)	245 (1.1)
			1 (25)	**205** (0.91)	**260** (1.16)	**215** (0.96)	**155** (0.69)	330 (1.5)	330 (1.5)
			1-1/4 (32)	**315** (1.40)	**435** (1.93)	**295** (1.31)	**200** (0.89)	375 (1.7)	375 (1.7)
			1-1/2 (38)	**425** (1.89)	**475** (2.11)	**400** (1.78)	**260** (1.16)	430 (1.9)	430 (1.9)
Standard Fastener	X-C (Black collated strip or guidance washer)	**0.138** (3.5)	**3/4** (19)	**120** (0.53)	**175** (0.78)	**120** (0.53)	**95** (0.42)	265 (1.2)	265 (1.2)
			1 (25)	**180** (0.80)	**260** (1.16)	**215** (0.96)	**155** (0.69)	485 (2.2)	485 (2.2)
			1-1/4 (32)	**225** (1.00)	**400** (1.78)	**250** (1.11)	**200** (0.89)	500 (2.2)	500 (2.2)
			1-1/2 (38)	**285** (1.27)	**400** (1.78)	**285** (1.27)	**210** (0.93)	555 (2.5)	555 (2.5)
Heavy Duty Fastener	DS[4]	**0.177** (4.5)	**3/4** (19)	**100** (0.44)	**200** (0.89)	**100** (0.44)	–	200 (0.9)	200 (0.9)
			1 (25)	**180** (0.80)	**360** (1.60)	**180** (0.80)	**180** (0.80)	405 (1.8)	405 (1.8)
			1-1/4 (32)	**300** (1.33)	**520** (2.31)	**300** (1.33)	**250** (1.11)	515 (2.3)	515 (2.3)
			1-1/2 (38)	**450** (2.00)	**680** (3.02)	**450** (2.00)	**325** (1.45)	625 (2.8)	625 (2.8)
Stainless Steel Fastener	X-CR	**0.145** (3.7)	**1** (25)	**230** (1.02)	**240** (1.07)	**230** (1.02)	–	240 (1.1)	240 (1.1)
			1-1/4 (32)	**320** (1.42)	**400** (1.78)	**320** (1.42)	–	400 (1.8)	400 (1.8)
			1-1/2 (38)	**405** (1.80)	**500** (2.22)	**405** (1.80)	–	500 (2.2)	500 (2.2)
Gas Fastener	X-GN, X-C B3, X-C G3	**0.118** (3.0)	**3/4** (19)	**115** (0.5)	**140** (0.6)	**75** (0.3)	**85** (0.4)	175 (0.8)	215 (1.0)
			1 (25)	**170** (0.8)	**220** (1.0)	**155** (0.7)	**160** (0.7)	255 (1.1)	315 (1.4)
Premium Gas Fastener	X-GHP, X-P 17 G2, X-P 20 G2, X-P G3, X-P B3	**0.118** (3.0)	**5/8** (16)	**60** (0.3)	**140** (0.6)	**60** (0.3)	**60** (0.3)	175 (0.8)	215 (1.0)

1 The tabulated allowable load values are for the low-velocity fasteners only, using a safety factor that is greater than or equal to 5.0, calculated in accordance with ICC-ES AC70. Wood or steel members connected to the substrate must be investigated in accordance with accepted design criteria.

2 The steel deck profile is 3" deep composite floor deck with a minimum thickness of 20 gauge (0.0358"). Figure 1 (Section 3.2.1.6) shows the nominal flute dimensions, fastener locations, and load orientations for the deck profile.

3 Structural lightweight concrete fill above top of metal deck shall be a minimum of 3-1/4" deep.

4 DS fasteners installed at 1-1/2" embedment through steel deck into the lower flute must be installed at a minimum distance of 6" from the edge of the floor deck.

5 Multiple fasteners are recommended for any attachment.

* More details about the innovative X-P and X-U fasteners can be found in Section 3.2.6.

Allowable Loads Into Minimum f'_c = 3000 psi Structural Lightweight Concrete Over 1-1/2" Deep, B-Type Steel Deck[1,4]

Fastener description	Fastener	Shank diameter in.	(mm)	Minimum embedment in.	(mm)	Fastener location installed through metal deck into concrete[2,3] Tension lb (kN) Upper flute		Lower flute		Shear lb	(kN)
Premium concrete fastener	X-P*	**0.157**	(4.0)	**3/4**	(19)	**140**	(0.6)	**130**	(0.6)	**335**	(1.5)
				1	(25)	**215**	(1.0)	**215**	(1.0)	**385**	(1.7)
				1-1/4	(32)	–		**270**	(1.2)	**465**	(2.1)
Universal knurled shank fastener	X-U*	**0.157**	(4.0)	**3/4**	(19)	**95**	(0.42)	**95**	(0.42)	**370**	(1.65)
				1	(25)	**125**	(0.56)	**125**	(0.56)	**415**	(1.85)
Standard fastener	X-C	**0.138**	(3.5)	**3/4**	(19)	**80**	(0.36)	**80**	(0.36)	**315**	(1.40)
				1	(25)	**205**	(0.91)	**205**	(0.91)	**445**	(1.98)
Gas fastener	X-GN, X-C B3, X-C G3	**0.118**	(3.0)	**3/4**	(19)	**75**	(0.3)	**85**	(0.38)	**175**	(0.8)
				1	(25)	**155**	(0.7)	**160**	(0.71)	**255**	(1.1)
Premium gas fastener	X-GHP, X-P 17 G2, X-P 20 G2, X-P G3, X-P B3	**0.118**	(3.0)	**5/8**	(16)	**60**	(0.27)	**60**	(0.3)	**175**	(0.8)

1 The tabulated allowable load values are for the low-velocity fasteners only, using a safety factor that is greater than or equal to 5.0, calculated in accordance with ICC-ES AC70. Wood or steel members connected to the substrate must be investigated in accordance with accepted design criteria.

2 Steel deck profiles are 1-1/2" deep, B-type deck with a minimum thickness of 20 gauge (0.0358" thick steel). Fasteners may be installed through the metal deck into lightweight concrete having both nominal and inverted deck profile orientations with a minimum lower flute width of 1-3/4" or 3-1/2", respectively. Fasteners shall be placed at centerline of deck flutes. Refer to Figures 2 and 3 (Section 3.2.1.6) for additional flute dimensions, fastener locations, and load orientations for both deck profiles.

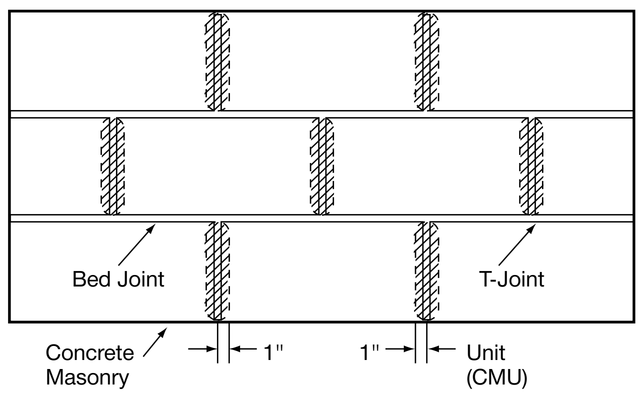
3 Structural lightweight concrete fill above top of metal deck shall be a minimum 2-1/2" deep.

4 Multiple fasteners are recommended for any attachment.

Allowable Loads in Concrete Masonry Units[1,2,3,4,5,10]

Fastener Description	Fastener	Shank diameter in. (mm)	Min. embed. in. (mm)	Hollow CMU				Grout filled CMU					
				Face shell[6]		Mortar joint		Face shell[6]		Mortar joint		Top of grouted cell[8]	
				Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear[7] lb (kN)	Tension lb (kN)	Shear lb (kN)	Tension lb (kN)	Shear[7] lb (kN)	Tension lb (kN)	Shear[9] lb (kN)
Premium concrete fastener	X-P*	**0.157** (4.0)	**1** (25)	**70** (0.31)	**105** (0.47)	**85** (0.38)	**70** (0.31)	**150** (0.67)	**145** (0.65)	**150** (0.67)	**155** (0.69)	**165** (0.73)	**240** (1.07)
Universal knurled shank fasteners	X-U*	**0.157** (4.0)	**1** (25)	**70** (0.31)	**85** (0.38)	**25** (0.11)	**70** (0.31)	**225** (1.00)	**220** (0.98)	**150** (0.67)	**190** (0.85)	**165** (0.73)	**240** (1.07)
Standard fastener	X-C	**0.138** (3.5)	**3/4** (19)	**40** (0.18)	**85** (0.38)	**25** (0.11)	**50** (0.22)	**100** (0.44)	**105** (0.47)	**45** (0.20)	**80** (0.36)	**115** (0.51)	**175** (0.78)
Gas fastener	X-GN, X-C B3, X-C G3	**0.118** (3.0)	**3/4** (19)	**145** (0.65)	**190** (0.85)	**80** (0.36)	**80** (0.36)	**155** (0.69)	**195** (0.87)	**110** (0.49)	**135** (0.60)	**105** (0.47)	**145** (0.65)
			1 (25)	**185** (0.82)	**205** (0.91)	**105** (0.47)	**105** (0.47)	**205** (0.91)	**215** (0.96)	**135** (0.60)	**190** (0.85)	**120** (0.53)	**150** (0.67)
Gas fastener	X-C G2	**0.108** (2.7)	**3/4** (19)	**75** (0.33)	**140** (0.62)	**60** (0.27)	**80** (0.36)	**100** (0.44)	**170** (0.76)	**100** (0.44)	**160** (0.71)	**80** (0.36)	**130** (0.58)
			1 (25)	**110** (0.49)	**190** (0.85)	**70** (0.31)	**145** (0.65)	**135** (0.60)	**195** (0.87)	**125** (0.56)	**165** (0.73)	**110** (0.49)	**145** (0.65)

1 The tabulated allowable load values are for the low-velocity fastener only, using a safety factor of 5.0 or higher calculated in accordance with ICC-ES AC70. Wood or steel members connected to the substrate must be investigated in accordance with accepted design criteria.
2 The tabulated allowable load values are for low-velocity fasteners installed in normal weight or lightweight concrete masonry units conforming to ASTM C90.
3 The tabulated allowable load values are for low-velocity fasteners installed in concrete masonry units with mortar conforming to ASTM C270, Type N or S.
4 The tabulated allowable load values are for low-velocity fasteners installed in concrete masonry units with grout conforming to ASTM C476, as coarse grout.
5 The tabulated allowable load values are for one low-velocity fastener installed in an individual masonry unit cell and at least 4" from the edge of the wall.
6 Fastener can be located anywhere on the face shell or mortar joint as shown in the figure to the right.
7 Shear direction can be horizontal or vertical (Bed Joint or T-Joint) along the CMU wall plane.
8 Fastener located in center of grouted cell installed vertically.
9 Shear can be in any direction.
10 Multiple fasteners are recommended for any attachment.



Acceptable locations (NON-SHADED AREAS) for power-actuated fasteners in CMU walls

* More details about the innovative X-P and X-U fasteners can be found in Section 3.2.6.

Allowable loads in minimum ASTM A36 ($F_y \geq 36$ ksi, $F_u \geq 58$ ksi) steel[1,2,4,5]

Fastener description	Fastener	Shank diameter in. (mm)	Steel thickness (in.) 1/8 Tension lb (kN)	1/8 Shear lb (kN)	3/16 Tension lb (kN)	3/16 Shear lb (kN)	1/4 Tension lb (kN)	1/4 Shear lb (kN)	3/8 Tension lb (kN)	3/8 Shear lb (kN)	1/2 Tension lb (kN)	1/2 Shear lb (kN)	≥3/4 Tension lb (kN)	≥3/4 Shear lb (kN)
Universal knurled shank*	X-U[6]	**0.157** (4.0)	–	–	**535** (2.38)	**720** (3.20)	**775** (3.45)	**720** (3.20)	**935** (4.16)	**720** (3.20)	**900** (4.00)	**720** (3.20)	**350** (1.56)	**375** (1.67)
Stepped-shank knurling-lengthwise	X-U 15[7]	**0.145** (3.7)	–	–	**155** (0.69)	**395** (1.76)	**230** (1.02)	**395** (1.76)	**420** (1.86)	**450** (2.00)	**365** (1.62)	**500** (2.22)	**365** (1.62)	**400** (1.78)
Standard knurled shank	X-S13	**0.145** (3.7)	**140** (0.62)	**300** (1.33)	**300** (1.33)	**450** (2.00)	**300** (1.33)	**450** (2.00)	**300** (1.33)	**450** (2.00)	–	–	–	–
Drywall smooth shank w/metal top hat washer	X-S16	**0.145** (3.7)	–	–	**225** (1.00)	**420** (1.87)	**225** (1.00)	**430** (1.91)	**225** (1.00)	**430** (1.91)	**225** (1.00)	**430** (1.91)	–	–
Heavy duty knurled shank	EDS[3]	**0.177** (4.5)	–	–	**305** (1.36)	**615** (2.67)	**625** (2.78)	**870** (3.87)	**715** (3.18)	**870** (3.87)	**890** (3.96)	**960** (4.27)	**400** (1.78)	**655** (2.91)
Heavy duty smooth shank	DS	**0.177** (4.5)	–	–	**365** (1.62)	**725** (3.22)	**580** (2.58)	**725** (3.22)	**695** (3.09)	**725** (3.22)	**735** (3.27)	**860** (3.83)	–	–
Stainless steel smooth shank	X-R[10]	**0.145** (3.7)	–	–	**460** (2.05)	**460** (2.05)	**615** (2.74)	**500** (2.22)	–	–	–	–	–	–
	X-R[8,10]	**0.145** (3.7)	**300** (1.33)	**190** (0.85)	**615** (2.74)	**495** (2.20)	**760** (3.38)	**500** (2.22)	**220** (0.98)	**325** (1.45)	**225** (1.00)	**335** (1.49)	–	–
Standard gas fastener for steel	X-EGN 14[9], X-S 14 B3	**0.118** (3.0)	**140** (0.6)	**230** (1.0)	**220** (1.0)	**245** (1.1)	**225** (1.0)	**290** (1.3)	**280** (1.2)	**330** (1.5)	**280** (1.2)	**330** (1.5)	**280** (1.2)	**330** (1.5)
Standard gas fastener for steel	X-EGN 14[8,9] X-S 14 B38	**0.118** (3.0)	–	–	**220** (1.0)	**295** (1.3)	**260** (1.2)	**355** (1.6)	**280** (1.2)	**385** (1.7)	**280** (1.2)	**385** (1.7)	**280** (1.2)	**385** (1.7)
Premium gas fastener	X-GHP, X-P G3, X-P B3	**0.118** (3.0)	**125** (0.6)	**230** (1.0)	**170** (0.8)	**245** (1.1)	**200** (0.9)	**230** (1.0)	**250** (1.1)	**255** (1.1)	–	–	–	–

1 The tabulated allowable load values are for the low-velocity fasteners only, using a safety factor that is greater than or equal to 5.0, calculated in accordance with ICC-ES AC70. Wood or steel members connected to the substrate must be investigated in accordance with accepted design criteria.
2 Low-velocity fasteners shall be driven to where the point of the fastener penetrates through the steel base material in accordance with Section 3.2.2.3, except as noted in this table.
3 EDS fasteners installed into greater than 1/2" thick steel require 1/2" minimum penetration.
4 Multiple fasteners are recommended for any attachment.
5 Refer to guidelines for fastening to steel, Section 3.2.2, for application limits.
6 Tabulated allowable load values provided for 3/4" steel are based upon minimum point penetration of 1/2" into the steel. If 1/2" point penetration into the steel is not achieved, but a point penetration of at least 3/8" is obtained, the tabulated tension value should be reduced by 20 percent and the tabulated shear load should be reduced by 8 percent.
7 X-U 15 fasteners installed into greater than 3/8" thick steel require 15/32" minimum penetration into the steel.
8 Based on testing with F_y = 50 ksi base material.
9 Fasteners installed into 3/8" or thicker base steel require 0.320" minimum penetration depth into the steel.
10 Fasteners installed into 3/8" or thicker base require 0.38" minimum penetration depth into the steel.

Allowable tensile pullover and shear bearing load capacities for steel framing with power driven fasteners[1,2,3,4]

Fastener description	Fastener	Head dia. in. (mm)	Sheet steel thickness 14 ga. Tension lb (kN)	14 ga. Shear lb (kN)	16 ga. Tension lb (kN)	16 ga. Shear lb (kN)	18 ga. Tension lb (kN)	18 ga. Shear lb (kN)	20 ga. Tension lb (kN)	20 ga. Shear lb (kN)	22 ga. Tension lb (kN)	22 ga. Shear lb (kN)	24 ga. Tension lb (kN)	24 ga. Shear lb (kN)	25/26 ga. Tension lb (kN)	25/26 ga. Shear lb (kN)
0.157" shank with or w/o plastic washers or MX collation	X-U, X-P	**0.322** (8.2)	**825** (3.67)	**1,085** (4.83)	**685** (3.05)	**720** (3.20)	**490** (2.18)	**525** (2.34)	**360** (1.60)	**445** (1.98)	**300** (1.33)	**330** (1.47)	**205** (0.91)	**255** (1.13)	**120** (0.53)	**145** (0.64)
0.145" shank with or w/o plastic washers or MX collation	X-C, X-R	**0.322** (8.2)	–	**985** (4.38)	**685** (3.05)	**720** (3.20)	**490** (2.18)	**515** (2.29)	**360** (1.60)	**440** (1.96)	**300** (1.33)	**310** (1.38)	**205** (0.91)	**235** (1.05)	**120** (0.53)	**145** (0.64)
0.177" shank without washer	DS, EDS	**0.322** (8.2)	**965** (4.29)	**1,085** (4.83)	**810** (3.60)	**815** (3.63)	**625** (2.78)	**535** (2.38)	**460** (2.05)	**465** (2.07)	**360** (1.60)	**350** (1.56)	**300** (1.33)	**260** (1.16)	**240** (1.07)	**180** (0.80)
0.145" shank with plastic top hat washers	X-S13 THP X-S16 TH	**0.322** (8.2)	–	**985** (4.38)	**685** (3.05)	**720** (3.20)	**490** (2.18)	**515** (2.29)	**360** (1.60)	**440** (1.96)	**300** (1.33)	**310** (1.38)	**205** (0.91)	**235** (1.05)	**120** (0.53)	**145** (0.64)
0.118" shank with MX collation	X-EGN, X-GN, X-GHP	**0.276** (6.8)	–	–	–	–	**325** (1.45)	**390** (1.73)	**265** (1.18)	**335** (1.49)	**250** (1.11)	**235** (1.05)	**170** (0.76)	**185** (0.82)	**100** (0.44)	**125** (0.56)

1 Allowable load values are based on a safety factor of 3.0.
2 Allowable pullover capacities of sheet steel should be compared to the allowable fastener tensile load capacities in concrete, steel, and masonry to determine controlling resistance load.
3 Allowable shear bearing capacities of sheet steel should be compared to allowable fastener shear capacities in concrete, steel and masonry to determine controlling resistance load.
4 Data is based on the following minimum sheet steel properties, F_y = 33 ksi, F_u = 45 ksi (ASTM A653 material).

* More details about the innovative X-U fastener can be found in Section 3.2.6.

3.2.5.4 ORDERING INFORMATION

Carbon steel non-collated (without pre-mounted steel washer)

Fastener description	Shank length in. (mm)	Shank Ø in. (mm)	Washer Ø
Concrete, Masonry and Steel			
X-U P8*	**5/8 to 2-7/8** (16 to 72)	**0.157** (4.0)	8 mm plastic
X-U P8 TH*	**5/8, 3/4, 1** (16, 19, 27)	**0.157** (4.0)	8 mm plastic and metal tophat
Concrete and Masonry			
X-P P8	**7/8 to 1-9/16** (22 to 40)	**0.157** (4.0)	8 mm plastic
DS P10	**1 to 2-1/2** (27 to 62)	**0.177** (4.5)	8 mm plastic
X-C P8	**1 to 2-1/2** (19 to 62)	**0.138** (3.5)	8 mm plastic
X-C THP	**3/4** (20)	**0.138** (3.5)	8 mm plastic tophat
Steel			
X-S13 THP	**1/2** (13)	**0.145** (3.7)	8 mm plastic tophat
X-S16 TH	**5/8** (16)	**0.145** (3.7)	8 mm plastic and metal tophat
EDS P10	**3/4, 7/8** (19, 22)	**0.177** (4.5)	10 mm plastic

Carbon steel collated (without pre-mounted steel washer)

Fastener description	Shank length in. (mm)	Shank Ø in. (mm)	Washer Ø
Concrete, Masonry and Steel			
X-U MX*	**5/8 to 2-7/8** (16 to 72)	**0.157** (4.0)	Collated
Concrete and Masonry			
X-P MX	**7/8 to 1-9/16** (22 to 40)	**0.157** (4.0)	Collated
X-C MX	**1 to 2-1/2** (27 to 62)	**0.138** (3.5)	Collated
X-GN MX	**3/4 to 1-1/4** (20 to 32)	**0.118** (3.0)	Collated
X-GHP MX	**11/16, 3/4** (18, 20)	**0.118** (3.0)	Collated
Steel			
X-S13 MX	**1/2** (13)	**0.145** (3.7)	Collated
X-EGN MX	**1/2** (14)	**0.118** (3.0)	Collated
X-GHP MX	**11/16, 3/4** (18, 20)	**0.118** (3.0)	Collated

Carbon steel non-collated (with pre-mounted steel washer)

Fastener description	Shank length in. (mm)	Shank Ø in. (mm)	Washer Ø
Concrete, Masonry and Steel			
X-U P8 S15*	**7/8, 1, 1-1/4** (22, 27, 32)	**0.157** (4.0)	8 mm plastic and 15 mm steel
X-U P8 S36*	**1-1/4, 2-7/8** (32, 72)	**0.157** (4.0)	8 mm plastic and 36 mm steel
Concrete and Masonry			
X-C P8 S23	**1 to 1-7/8** (27 to 47)	**0.138** (3.5)	8 mm plastic and 23 mm steel
X-C P8 S36	**1-1/2, 2, 2-1/2** (37, 52, 62)	**0.138** (3.5)	8 mm plastic and 36 mm steel

SAE 316 stainless steel non-collated (with and without pre-mounted steel washer)

Fastener description	Shank length in. (mm)	Shank Ø in. (mm)	Washer Ø
Concrete and Masonry			
X-CR P8	**1/2 to 1-9/16** (14 to 39)	**0.145** (3.7)	8 mm plastic
X-CR P8	**1-3/4, 2-1/8** (44, 54)	**0.157** (4.0)	8 mm plastic
X-CR P8 S12	**1-9/16** (39)	**0.145** (3.7)	8 mm plastic and 12 mm steel
X-CR P8 S12	**1-3/4** (44)	**0.157** (4.0)	8 mm plastic and 12 mm steel
Steel			
X-R P8	**9/16** (14)	**0.145** (3.7)	8 mm plastic
X-CR S12	**5/8** (16)	**0.145** (3.7)	12 mm steel

Carbon steel removable and clip fasteners

Fastener description	Shank length in. (mm)	Shank Ø in. (mm)	Washer Ø
Forming Nail			
X-CT 47MX, X-CT 62 MX, X-CT 62 DP8	**1-7/8, 2-7/16** (47, 62)	**0.145** (3.7)	Double 8 mm plastic
Rebar Basket Clip			
BC X-C P8T	**1-7/8, 2-7/16** (47, 62)	**0.145** (3.5)	8 mm plastic & rebar basket clip

* More details about the innovative X-U fastener can be found in Section 3.2.6.

ANGLE CLIP IN CONCRETE

PART NUMBER SERIES	SHANK DIAMETER (INCH)	MINIMUM PENETRATION (INCH)	ALLOWABLE WORKING VALUES INSTALLED IN NORMAL WEIGHT CONCRETE ALLOWABLE LOAD - *Ultimate Load*					
			4000 PSI			6000 PSI		
			TENSION (LBS)	SHEAR (LBS)	OBLIQUE (LBS)	TENSION (LBS)	SHEAR (LBS)	OBLIQUE (LBS)
SDC100 SDC125	0.145	7/8	**115** *575*	**120** *1014*	**145** *726*	....	....	....
SDC125	0.145	1-1/8	**130** *744*	**167** *1090*	**205** *1032*	....	....	....
SPC78	0.150	3/4	**155** *897*	**188** *1050*	....	**150** *788*	**153** *949*	**140** *769*
SPC114	.150/.180	1-1/8	**127** *811*	**226** *1130*	**181** *904*	**169** *853*	**300** *1500*	**223** *1114*

PART NUMBER SERIES	SHANK DIAMETER (INCH)	MINIMUM PENETRATION (INCH)	ALLOWABLE WORKING VALUES INSTALLED IN 3000 PSI LIGHTWEIGHT CONCRETE ALLOWABLE LOAD - *Ultimate Load*				
			3000 PSI LIGHTWEIGHT WITH METAL DECKING				
			LOWER FLUTE TENSION (LBS)	LOWER FLUTE SHEAR (LBS)	LOWER FLUTE OBLIQUE (LBS)	UPPER FLUTE TENSION (LBS)	UPPER FLUTE SHEAR (LBS)
SDC100 SDC125	0.145	7/8	**67** *335*	**237** *1186*	**90** *448*	**104** *571*	**310** *1678*
SDC125	0.145	1-1/8	**94** *471*	**276** *1378*	**119** *596*	**106** *528*	**319** *1597*
SPC78	0.150	3/4	**59** *293*	**202** *1109*	**65** *323*	**84** *419*	**324** *1622*
SPC114	.150/.180	1-1/8	**157** *786*	**272** *1358*	**153** *766*	**180** *899*	**334** *1673*

Note 1: ALLOWABLE loads are shown in the **LARGE BOLD** font, *Ultimate* loads are shown in *smaller italic* font. **Note 2:** Testing conducted in accordance with ICC AC70 & ASTM E1190. **Note 3:** Safety factors are based on coefficient of variation. In accordance with ICC AC70, the safety factor will be no less than 5. **Note 4:** Values shown in concrete are for the clip assembly only. Connected members must be investigated separately. **Note 5:** Cyclic, fatigue, shock loads, and other design criteria may require a different safety factor. **Note 6:** Job site testing may be required to determine actual job site values. **Note 7:** Minimum edge distance is 3 inches unless otherwise approved. **Note 8:** For SI: 1 lbf = 4.448 N, 1 inch = 25.4 mm, 1 ksi = 6.89MPa. **Note 9:** Metal deck is 20g.

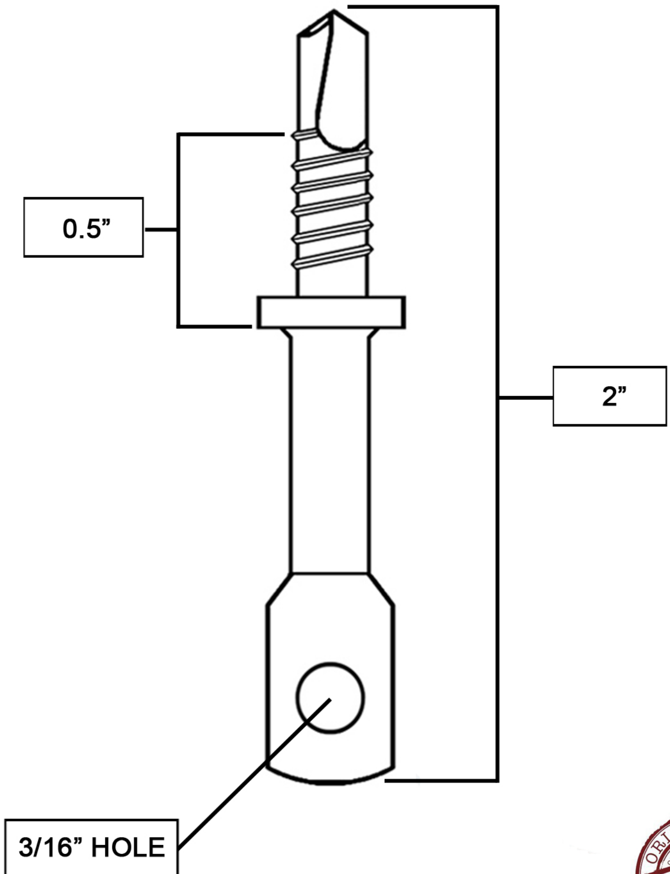
LADD 652 ANGLE CLIP ASSEMBLY

PART NUMBER SERIES	SHANK DIAMETER (INCH)	MINIMUM PENETRATION (INCH)	ALLOWABLE WORKING VALUES INSTALLED IN STONE AGGREGATE CONCRETE CONCRETE COMPRESSIVE STRENGTH ALLOWABLE LOAD - *Ultimate Load*			
			3000 PSI		4000 PSI	
			TENSION (LBS)	SHEAR (LBS)	TENSION (LBS)	SHEAR (LBS)
LADD CEILING SYSTEM	0.152	1-1/8	**211** *1688*	....	**193** *1544*	....

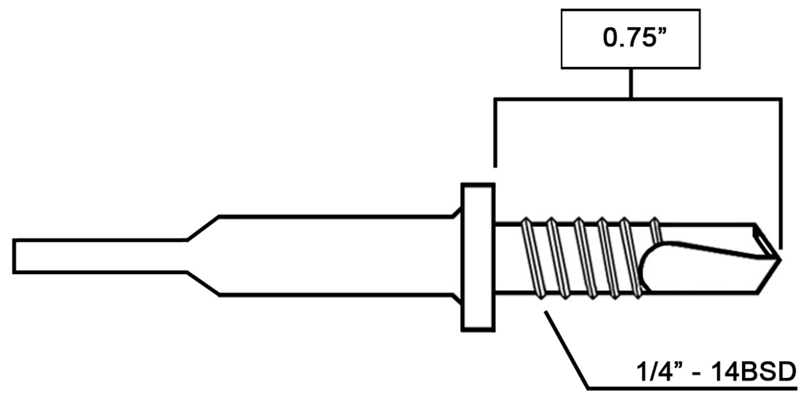
Note 1: ALLOWABLE loads are shown in the **LARGE BOLD** font, *Ultimate* loads are shown in *smaller italic* font. **Note 2:** Except as noted, values shown reflect an 8 to 1 safety factor. **Note 3:** Values shown are for concrete at the designed strength and are for the clip system only. **Note 4:** Cyclic, fatigue or shock loads and other design criteria may require a different safety factor. **Note 5:** Job site testing may be required to determine actual job site values. **Note 6:** Edge distance is 3 inches unless otherwise approved. **Note 7:** For SI: 1 lbf = 4.448 N, 1 inch = 25.4 mm, 1 ksi = 6.89MPa

REV	DESCRIPTION	DATE	APPROVAL

FRONT VIEW



SIDE VIEW



ICC ES ™
ESR-3135

RoHS Compliant

Notes: I-LAG™ Brand eye lag screw part # 750SD, Self-drilling screw designed specifically for suspended ceiling applications only. ICC ESR-3135, distributed by Doc’s Industries, Inc. Simi Valley, CA 93063
(For tension applications only)

Material	CHQ 1022 STEEL
Finish	Electro-Galvanized Yellow Zinc Cr3+

Release Approval:	Tolerances: .X = + / - 0.02in .XX = + / - 0.01in .XXX = + / - .005in Unless Otherwise Specified
Release Date:	Proprietary Rights: All information that is contained within is proprietary. Not for unauthorized use or disclosure.
Customer Approval:	

DOC’S
DOC’S INDUSTRIES, INC.

Title: **I-LAG™ 750SD**

Size:	Scale:	Part Number:	Rev:
A	None	750SD	

Date: 8/28/13	Drawn by: RO
Drawing Number: 0176	Sheet 1 of X

Structural Design Calculations
COSTCO Garage

Interior / Exterior Suspended Ceiling

Issaquah, Washington

Prepared For: PCI
Project No.: 20-086
Date: February 16, 2021

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Structural Design Calculations

for

Interior / Exterior Suspended Ceiling

Issaquah, Washington

Devco Job # 20-086
February 16, 2021

BENJAMIN PRUETT
STATE OF WASHINGTON
55849
REGISTERED
PROFESSIONAL ENGINEER
DIGITAL SIGNATURE

ENGINEERS NORTHWEST, INC. is not responsible for this design or performance of this product.

ENGINEERS NORTHWEST, INC. has reviewed the applied loads only for conformance to the construction documents and has reviewed absolutely nothing else

02-25-2021	CAR
Date	By

COSTCO

WIND LOAD - ASCE 7-10

110 mph, Exposure B, Mean Roof Height = 105.0 ft
K_{zt} at Base = 1
K_d = 0.85 , Roof Slope 0.0 degrees
Enclosed Building, GC_{pi} = 0.18
(Wind Loads Shown are for Alternate Basic Load Combinations Using Allowable Stress Design and are Multiplied by a Factor of 0.6 to convert to ASD)

WALL COMPONENTS AND CLADDING per ASCE7-10 Figure 30.6-1

GCp by Zone

	Zone 4 (+/-)	Zone 5 (+/-)
20 ft^2	0.90/-0.90	0.90/-1.80
500 ft^2	0.60/-0.70	0.60/-1.00

Height				Wind Pressures (psf) by Zone ()					
				Windward (4,5)		Leeward (4)		Leeward (5)	
z (ft)	K_z	K_{zt}	q_z (psf)	A=20	A=500	A=20	A=500	A=20	A=500
105	1.00	1.00	26.38	17.1	12.3	-17.1	-13.9	-31.3	-18.7

DEVCO engineering inc.

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(541) 757-8991
Fax: (541) 757-9885

Seismic Design Values

Per ASCE 7

Seismic Properties

	Risk Category =	II	
Design Spectral Acceleration	SDS =	0.634	Per Stuctural General Note Sheet
Amplication Factor	ap =	1.0	
Response Modification Factor	Rp =	2.5	
Importance Factor	I =	1.00	
Design Ceiling Weight Min	W =	4.0	psf Minimum per ASCE7 13.5.6.1
Design Height	Z =	1.0	ft
Bdlg Height	H =	1.0	ft

Seismic Design Force

Seismic Design Force Fp $\boxed{\dfrac{0.4 * ap * SDS * W}{\left(\dfrac{Rp}{Ip}\right)}\left(1+\dfrac{2 * Z}{H}\right)}$

Maximum Design Force Fpmax = $\boxed{1.6 * SDS * Ip * W}$

Minimum Design Force Fpmin = $\boxed{.3 * SDS * Ip * W}$

Fp =	0.30	x Weight
Fpmax =	1.01	x Weight
Fpmin =	0.19	x Weight

Seismic Design Value ASD Fp = 0.22 x Weight

DEVCO engineering inc.

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PROJECT: COSTCO	PROJECT NO: 20-086	DESIGN: B.J.P.	DATE: 10/2020

Suspended Ceiling Design

Per IBC

Seismic Properties

Seismic Response Coefficient Cs =	0.22		

Ceiling Properties

Ceiling Weight W =	4.0	psf	
in Ceiling Weight "Seismic Calc" W =	4.0	psf	per ASCE7-10 13.5.6.1
Main Tee Spacing Sm =	4.0	ft	
Cross Tee Spacing Sc =	2.0	ft	

Splay Wire

Splay Wire Angle	45	degrees	
Splay Wire Gauge	12GA		
Ta	209	lb	
Max Splay Wire Tributary Area	168	ft^2	

Wire Hanger

Wire Spacing Along Mains	4.0	ft	
Wire Hanger Gauge	12GA		
Ta	209	lb	
Tmax	64	lb	OK

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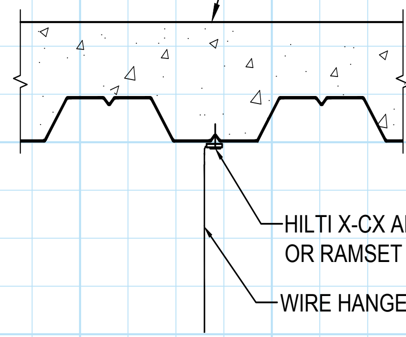
Fax: (541) 757-9885

PROJECT: COSTCO	PROJECT NO: 20-086	DESIGN: B.J.P.	DATE: 10/2020

HANGER WIRE CONNECTIONS

DESIGN LOADS
Tmax = 4PSF x 4ft x 4ft = 64lb (INTERIOR)
Tmax = (4PSF + 17.1PSF) x 2ft x 1.5ft = 64lb (EXTERIOR)

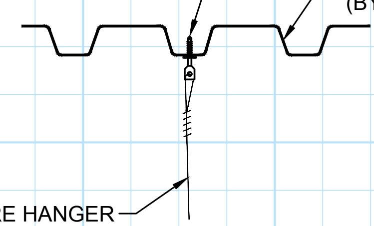


CONCRETE OVER METAL DECK

HILTI X-CX ALH32 per ICC ESR 2184
Ta = 150lb > Tmax

RAMSET SPC 114 per ICC ESR 1799
Ta = 157lb > Tmax

USE HILTI X-CX ALH32 OR RAMSET SPC 114



ROOF METAL DECK

ILAG 750SD ICC ESR 3135
Ta = 82lb > Tmax

USE I LAG 750SD @ MIN 20GA ROOF DECK

CONCRETE P.T. SLAB (Fc' = 4KSI MIN)

HILTI X-CX ALH27 per ICC ESR 2184
Ta = 110lb > Tmax

RAMSET SPC 78 per ICC ESR 1799
Ta = 150lb > Tmax

USE HILTI X-CX ALH27 OR RAMSET SPC 78

TABLE 9—ALLOWABLE TENSION AND SHEAR VALUES FOR CEILING CLIP ASSEMBLIES INSTALLED IN MINIMUM 3000 psi SAND-LIGHTWEIGHT CONCRETE FILLED STEEL DECK PANEL [1,2,3]

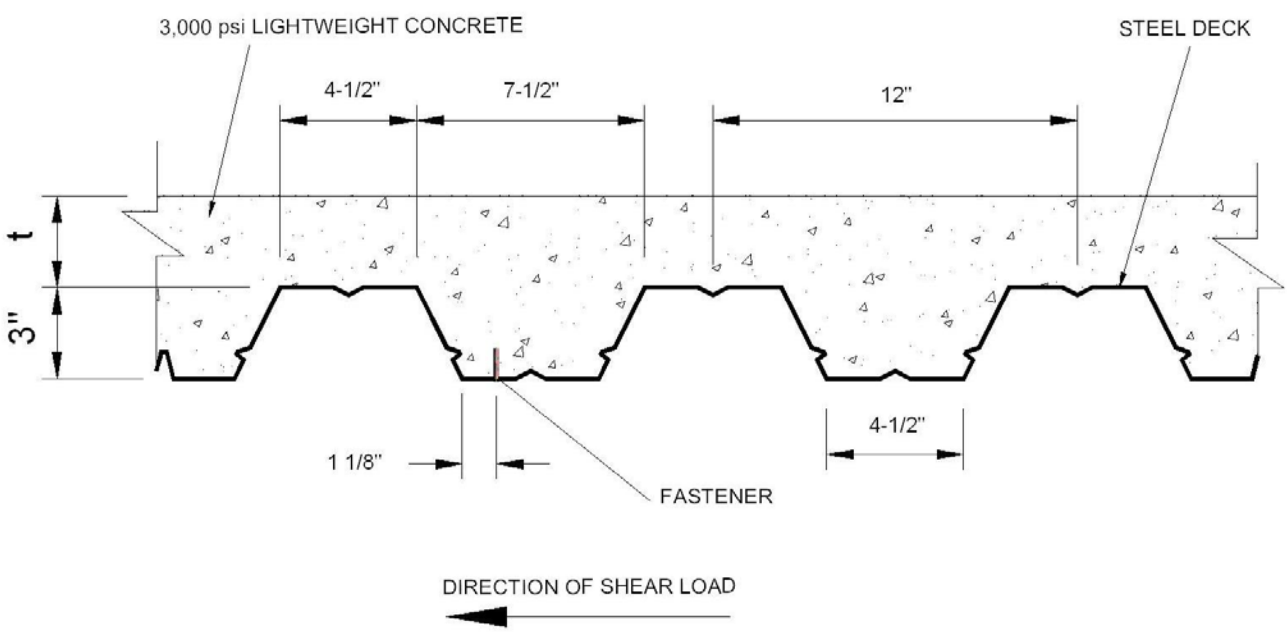
PART NUMBER	NOMINAL SHANK DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH (inches)	MINIMUM SPACING (inches)	ALLOWABLE LOADS (lbf)			
Fastener Installation Location and Loading Condition:				Lower Flute Tension	Lower Flute Shear	Upper Flute Tension	Upper Flute Shear
SDC100	0.145	$^7/_8$	4	67	237	104	310
SDC125	0.145	$1^1/_8$	4	94	276	106	319
SPC78	0.150	$^7/_8$	4	59	202	84	324
SPC114	0.150/0.180	$1^1/_8$	4	$\boxed{157}$	272	180	334
TEC100	0.157	$^7/_8$	5.1	88	—	—	—

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 6.89 kPa.

[1]The fasteners must not be driven until the concrete has reached the designated minimum compressive strength. Minimum concrete thickness above the deck must be a minimum of $3^1/_2$ inches ($2^1/_4$ inches for TEC fasteners).

[2]For fasteners installed through steel deck, the fastener must be installed through and into the upper or lower flute of the deck with a minimum edge distance of $1^1/_8$ inches from the edge of the steel deck and 4 inches (5.1 inches for TE fasteners) from the end of the deck panel.

[3]The steel deck panel must be configured as shown in Figure 1 and have a minimum base-metal thickness of 0.035 inch and minimum yield strength of 50 ksi and a minimum tensile strength of 65 ksi.



For **SI:** 1 inch = 25.4 mm.

See Tables 4 and 9.

t = $3^1/_2$″ for 1500 and SP Series Fasteners (See Table 4)

t = $3^1/_2$″ for SDC100, SDC125, SPC78, and SPC114 (See Table 9)

t = $2^1/_4$″ for TE Series Fasteners (See Tables 4 and 9)

FIGURE 1—FASTENER INSTALLATION LOCATION IN SAND-LIGHTWEIGHT CONCRETE FILLED 3 INCH DEEP STEEL DECK

TABLE 6—ALLOWABLE LOADS FOR FASTENERS INSTALLED IN ASTM A572 GRADE 50 OR ASTM A992 STEEL[1] (lbf)

PART NUMBER SERIES	NOMINAL SHANK DIAMETER (inch)	TYPE OF SHANK	MINIMUM SPACING (inch)	MINIMUM EDGE DISTANCE (inch)	ALLOWABLE LOADS (lbf)									
Steel Thickness (inch):					3/16		1/4		3/8		1/2		≥3/4	
Load Direction:					Tension[4]	Shear	Tension[4]	Shear	Tension	Shear	Tension	Shear	Tension	Shear
1500K (excluding 1506B)	0.145	Knurled	1	1/2	260	499	579	725	383[2]	595[2]	—	—	—	—
SP	0.150	Smooth	1	1/2	356	569	554	637	604[4]	602	814[3]	820[3]	243[4]	381[4]
TE	0.157	Knurled	1	1/2	442	676	630	662	760[4]	725	582[4]	532	311[2]	467[2]

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N.

[1]Except where noted otherwise in this table, the allowable load values shown are for fastenings that have the entire pointed end of the fasteners driven through the steel plate.

[2]Fastener penetration into the steel must be a minimum of 3/8 inch.

[3]Fastener penetration into the steel must be a minimum of 1/2 inch.

[4]Fastener penetration into the steel must be a minimum of 7/16 inch.

[4]For steel-to-steel connections designed in accordance with Section 4.1.4, the tabulated allowable load may be increased by a factor of 1.25, and the design strength may be taken as the tabulated allowable load multiplied by a factor of 2.0.

TABLE 7—ALLOWABLE LOADS FOR FASTENERS DRIVEN INTO CONCRETE MASONRY UNITS[1,2]

PART NUMBER SERIES	SHANK DIAMETER (inch)	MINIMUM EMBEDMENT (inch)	ALLOWABLE LOADS (lbf)									
Masonry Type:			HOLLOW UNGROUTED CMU				GROUT-FILLED CMU					
Fastener Location:			Face Shell[3]		Mortar Joint[4]		Face Shell[3]		Mortar Joint[4]		Top of Grouted Cell[3,6]	
Load Direction:			Tension	Shear[7]	Tension	Shear[5]	Tension	Shear[7]	Tension	Shear[5]	Tension	Shear[7]
TE	0.157	1	33	100	42	68	139	145	91	127	165	171

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N.

[1]See Section 3.6.4 for CMU, mortar and grout requirements.

[2]Fasteners must be installed a minimum of 5.1 inches from the end of the wall.

[3]Fasteners must be installed at the center of the CMU cell. No more than one fastener may be installed in an individual CMU cell.

[4]Applicable to fasteners installed in the horizontal mortar joint (bed joint). Minimum fastener spacing must be 5.1 inches.

[5]Allowable shear load value applies to load applied perpendicular to the mortar joint.

[6]Fastener must be installed vertically at the top, center of grouted cell.

[7]Shear load can be in any direction perpendicular to the axis of the fastener.

TABLE 8—ALLOWABLE TENSION AND SHEAR VALUES FOR CEILING CLIP ASSEMBLIES INSTALLED IN NORMALWEIGHT CONCRETE[1]

PART NUMBER	NOMINAL SHANK DIAMETER (inch)	MINIMUM EMBEDMENT DEPTH (inches)	MINIMUM SPACING (inches)	MINIMUM EDGE DISTANCE (inches)	ALLOWABLE LOADS (lbf)			
Concrete Compressive Strength:					4000 psi		6000 psi	
Load Direction:					Tension	Shear	Tension	Shear
SDC100	0.145	7/8	4	3.2	115	120	—	—
SDC125	0.145	1 1/8	4	3.2	130	167	—	—
SPC78	0.150	3/4	5.1	3.2	$\boxed{155}$	188	$\boxed{150}$	153
SPC114	0.150/0.180	1 1/8	5	3.5	127	226	169	300
TEC100	0.157	7/8	5.1	3.5	207	—	—	—

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.45 N, 1 psi = 6.89 kPa.

[1]The fasteners must not be driven until the concrete has reached the designated minimum compressive strength. Minimum concrete thickness must be three times the fastener embedment into the concrete.

TABLE 1—HILTI CEILING CLIP ASSEMBLY TYPES

DESIGNATION	FASTENER SHANK DIAMETER (inch)	FASTENER SHANK LENGTH (inch)	EMBEDMENT OF FASTENER IN CONCRETE (inch)	APPLICABLE BASE MATERIAL	APPLICABLE LOAD TABLES
X-CX ALH22	0.177	0.866	$^3/_4$	Concrete Conc.-filled deck Steel	2, 3, 4
X-CX ALH27	0.177	1.063	$^7/_8$	Concrete Conc.-filled deck	2, 3
X-CX ALH32	0.177	1.260	1	Concrete Conc.-filled deck	2, 3
X-CX C27	0.138	1.063	$^7/_8$	Concrete Conc.-filled deck	2, 3

For **SI:** 1 Inch = 25.4 mm.

TABLE 2—ALLOWABLE LOADS FOR HILTI CEILING CLIP ASSEMBLIES INSTALLED IN NORMALWEIGHT CONCRETE [1, 2]

DESIGNATION	ALLOWABLE LOADS (lbf)					
Concrete Compressive Strength:	**4,000 psi**			**6,000 psi**		
Load Direction:	**Tension**	**Shear**	**45-Degree**	**Tension**	**Shear**	**45-Degree**
X-CX ALH22	90	—	125	90	—	125
X-CX ALH27	$\boxed{125}$	—	165	$\boxed{110}$	—	150
X-CX ALH32	160	—	210	145	—	200
X-CX C27	90	—	125	—	—	—

For **SI:** 1 inch = 25.4 mm; 1 lbf = 4.448 N; 1 psi = 6895 Pa.

[1] Allowable load values are for assemblies installed in concrete having the designated compressive strength at the time of installation.
[2] The concrete thickness at the point of penetration must be a minimum of three times the fastener embedment depth.

TABLE 3—ALLOWABLE LOADS FOR HILTI CEILING CLIP ASSEMBLIES INSTALLED INTO MINIMUM 3,000 psi STRUCTURAL SAND-LIGHTWEIGHT CONCRETE FILLED COMPOSITE STEEL DECK PANEL [1, 2]

DESIGNATION	ALLOWABLE LOAD (lbf)					
Fastener Location:	**Lower Flute**			**Upper Flute**		
Load Direction:	**Tension**	**Shear**	**45-Degree**	**Tension**	**Shear**	**45-Degree**
X-CX ALH22[3]	90	—	110	110	—	110
X-CX ALH27[3]	120	—	125	150	—	130
X-CX ALH32[3]	$\boxed{150}$	—	145	190	—	160
X-CX C27[4]	80	—	110	110	—	110

For **SI:** 1 inch = 25.4 mm; 1 lbf = 4.448 N; 1 psi = 6895 Pa, 1 ksi = 6.895 MPa.

[1] Allowable load values are for assemblies installed in concrete having the designated compressive strength at the time of installation.
[2] Deck panel must be 3-inch deep composite floor deck and have a minimum 0.0358 inch base-metal thickness, a minimum yield strength of 40 ksi and a minimum tensile strength of 55 ksi. See Figure 2 for deck configuration and required concrete topping thickness.
[3] Fasteners must be installed with a minimum of 3.5 inches from the end of the deck, and a minimum spacing of 5 inches.
[4] Fasteners must be installed with a minimum of 3 inches from the end of the deck, and a minimum spacing of 4 inches.

TABLE 4—ALLOWABLE LOADS FOR HILTI CEILING CLIP ASSEMBLIES INSTALLED IN STEEL [1, 2]

DESIGNATION	ALLOWABLE LOADS (lbf)								
Steel Thickness (inch):	$^1/_4$			$^3/_8$			$^1/_2$		
Load Direction:	**Tension**	**Shear**	**45-Degree**	**Tension**	**Shear**	**45-Degree**	**Tension**	**Shear**	**45-Degree**
X-CX ALH22	270	—	270	270	—	270	270	—	270

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.448 N.

[1] Steel must comply with Section 3.2.3 of this report.
[2] Allowable load capacities are based on base steel with a minimum yield strength (F_y) of 36 ksi and a minimum tensile strength (F_u) of 58 ksi.

5.1 The fasteners are manufactured and identified in accordance with this report.

5.2 Fastener installation complies with this report and the manufacturer's published installation instructions. In the event of conflict between this report and the published instructions, this report governs.

5.3 Available tension loads are as noted in Table 3. The stress increases and load reductions described in Section 1605.3.2 of the IBC are not allowed. No adjustments for duration of load are allowed.

5.4 Use of the screws to attach bracing wire to the supports is outside the scope of this report.

5.5 The allowable loads noted in Section 4.1 apply to the fasteners and their connection to the steel only. Adequacy of the steel deck to support the suspended loads must be justified to the satisfaction of the code official.

5.6 Calculations demonstrating that the applied loads are less than the allowable loads described in this report must be submitted to the code official for approval. The calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.7 Use of the fasteners is limited to dry, interior locations.

5.8 The fasteners are manufactured under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Self-drilling Tapping Screws Used to Attach Miscellaneous Building Materials to Steel Base Material (AC500), dated December 2017.

7.0 IDENTIFICATION

7.1 The I-Lag Brand screws are embossed with four I's radiating from the shank on the top portion of the collar as shown in Figure 1. The packaging is labeled with the fastener type, part number, report holder name (Doc's Industries, Inc.) and evaluation report number (ESR-3135).

7.2 The report holder contact information is the following:

DOC'S INDUSTRIES, INC.
4121 GUARDIAN STREET
SIMI VALLEY, CALIFORNIA 93063
(805) 583-9911
www.docsindustries.com

TABLE 1—I-LAG BRAND EYE LAG SCREWS

FASTENER TYPE	NOMINAL FASTENER SIZE (dia-tpi)	NOMINAL DIAMETER (in.)	LENGTH FROM UNDERSIDE OF COLLAR TO TIP (in.)	FASTENER "HEAD" LENGTH[1] (in.)	EYE DIAMETER (in.)	COLLAR DIAMETER AND THICKNESS (in.)
750 SD	$^1/_4$-14	0.250	$^3/_4$	$1^1/_4$	0.18	0.5 by 0.07
175 SD	$^1/_4$-14	0.250	$1^{15}/_{16}$	$1^1/_4$	0.18	0.5 by 0.07

For **SI:** 1 inch = 25.4 mm.

[1]Length from the underside of the collar to edge of the driving end of the fastener.

TABLE 2 — I-LAG™ BRAND EYE LAG SCREW FASTENER SHEAR AND TENSION STRENGTHS (lbf)

FASTENER TYPE	NOMINAL FASTENER SIZE	NOMINAL STRENGTH		ALLOWABLE STRENGTH (ASD)		DESIGN STRENGTH (LRFD)	
		Tension, P_{ts}	Shear, P_{ss}	Tension, (P_{ts}/Ω)	Shear, (P_{ss}/Ω)	Tension, (ΦP_{ts})	Shear, (ΦP_{ss})
750SD	$^1/_4$-14	1560	2527	520	872	780	1263
175SD	$^1/_4$-14	1560	2527	520	842	780	1263

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N.

TABLE 3 —AVAILABLE TENSION LOADS FOR I-LAG™ BRAND EYE LAG SCREWS INSTALLED IN STEEL DECK PANELS (lbf)[1,2]

FASTENER TYPE	MINIMUM DESIGN BASE METAL THICKNESS (inch)			
	0.030	**0.036**	**0.047**	**0.062**
ALLOWABLE STRENGTH (ASD)				
750 SD 175 SD	$\boxed{82}$	125	176	229
DESIGN STRENGTH (LRFD)				
750 SD 175 SD	131	201	281	366

For **SI:** 1 inch = 25.4 mm, 1 lbf = 4.4 N, 1 ksi = 6.895 MPa.

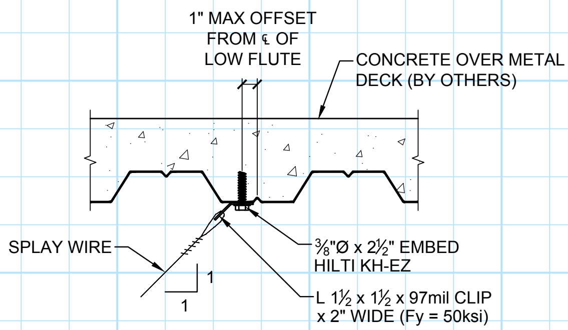
[1]The tabulated allowable load values are for the screws only, based on fastener strength and pullout capacity. Ceiling wire capacity is outside the scope of this report. Deck capacity is also outside the scope of this report.
[2]Values are based on installation into steel having a minimum tensile strength, F_u, of 45 ksi.

DEVCO engineering inc.
Physical Address
245 NE Conifer Blvd.
Corvallis, OR 97330
www.devcoengineering.com
Mailing Address
P.O. BOX 1211
Corvallis, OR 97339
(541) 757-8991
Fax: (541) 757-9885

PROJECT: COSTCO | **PROJECT NO:** 20-086 | **DESIGN:** B.J.P. | **DATE:** 10/2020

SPLAY WIRE CONNECTIONS

DESIGN LOADS
Rx = Ry = CsW =0.22 x 12ft x 12ft x 4psf = 126lb



Devco Engineering 10/20/2020

Hilti KH-EZ in Underside of Metal Deck

Deck Profile:	W2	(ESR-3027 Figure 5)
KH-EZ Size:	⅜" x 2 ½"	
Seismic Load:	Yes	
Concrete Strength f'c:	3000	psi
Minimum Spacing:	7.50''	along flute

<u>ANCHOR @ CONCRETE OVER METAL DECK</u>

T = 126lb x 1.5in / 0.75in = 253lb (seismic ASD)
V = 126lb (seismic ASD)

USE 3/8" Dia x 2 1/2" Hilti KH-EZ

	Tension	Shear
ASD Load (lb):	253	126
LRFD Factor(s):	1.40	1.40
Factored Load (lb):	354	176

	Tension	Shear
Nominal Strength (lb)	1590	905
Reduction Factor ϕ	0.65	0.60
Seismic Reduction Factor	0.75	1.00
Conversion Factor α	1.40	1.40
Allowable Strength (lb)	554	388

ESR-3027

Interaction **0.78 OK**

ANCHOR @ P.T CONCRETE SLAB

Tu = 1.4 x 126lb x 1.5in / 0.75in = 354lb (seismic LRFD)
V = 1.4 x 126lb = 176lb (seismic LRFD)

USE (3) 3/8" Diameter HDI-P-TZ

Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Jan 20, 2021	Date:	1/20/2021
Fastening point:			

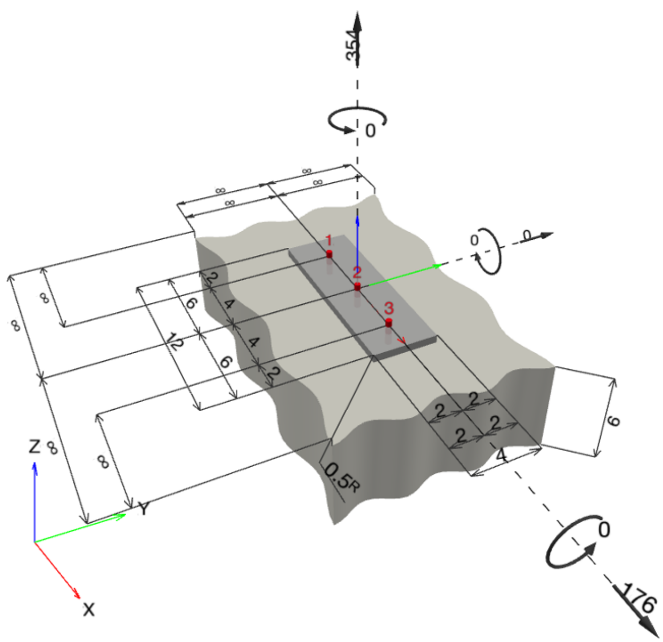
Specifier's comments:

1 Input data

Anchor type and diameter:	**HDI-P TZ 3/8**
Item number:	not available
Effective embedment depth:	h_{ef} = 0.750 in., h_{nom} = 0.750 in.
Material:	ASTM A 36
Evaluation Service Report:	ESR-4236
Issued I Valid:	4/1/2020 | 7/1/2021
Proof:	Design Method ACI 318 / AC193
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate[R] :	l_x x l_y x t = 12.000 in. x 4.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	Round bars (AISC), 1/16; (L x W x T) = 0.062 in. x 0.062 in.
Base material:	cracked concrete, 2500, f_c' = 2,500 psi; h = 6.000 in.
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present
	edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	yes (D.3.3.5)

[R] - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



Company:		Page:	2
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Jan 20, 2021	Date:	1/20/2021
Fastening point:			

1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 354; V_x = 176; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	yes	85

2 Proof I Utilization (Governing Cases)

Loading	Proof	Design values [lb] Load	Capacity	Utilization β_N / β_V [%]	Status
Tension	Pullout Strength	118	139	85 / -	OK
Shear	Pryout Strength	176	870	- / 21	OK

Loading	β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
Combined tension and shear loads	0.846	0.202	5/3	83	OK

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

SECTION DESIGNATION: 162S125-30 [33] Single

Section Dimensions:

Web Height =	1.625 in
Top Flange =	1.250 in
Bottom Flange =	1.250 in
Stiffening Lip =	0.188 in
Inside Corner Radius =	0.0782 in
Punchout Width =	0.750 in
Punchout Length =	4.000 in
Design Thickness =	0.0312 in

Steel Properties:

Fy =	33.000 ksi
Fu =	45.000 ksi
Fya =	33.000 ksi

ALLOWABLE AXIAL LOADS

INPUT PARAMETERS

Overall Stud Length = 8 ft
Load has not been modified for load type or duration
Member Configuration: SINGLE MEMBER

K-phi (axial) for Distortional Buckling = 0.00 lb*in/in

TOTAL ALLOWABLE AXIAL LOADS (lb)

WEAK AXIS BRACING	MAXIMUM KL/r	CONCENTRIC LOADING	LOADED THROUGH WEB
NONE	218	186	151
MID Pt	141	358	266
THIRD Pt	141	504	341

COMPRESSION POST
C = 126LB < 151LB OK

SECTION DESIGNATION: 162T125-30 [33] Single

Section Dimensions:

Web Height =	1.766 in
Top Flange =	1.250 in
Bottom Flange =	1.250 in
Inside Corner Radius =	0.0782 in
Design Thickness =	0.0312 in

Steel Properties:

Fy =	33.000 ksi
Fu =	45.000 ksi
Fya =	33.000 ksi

ALLOWABLE AXIAL LOADS

INPUT PARAMETERS

Overall Stud Length = 8 ft
Load has not been modified for load type or duration
Member Configuration: SINGLE MEMBER

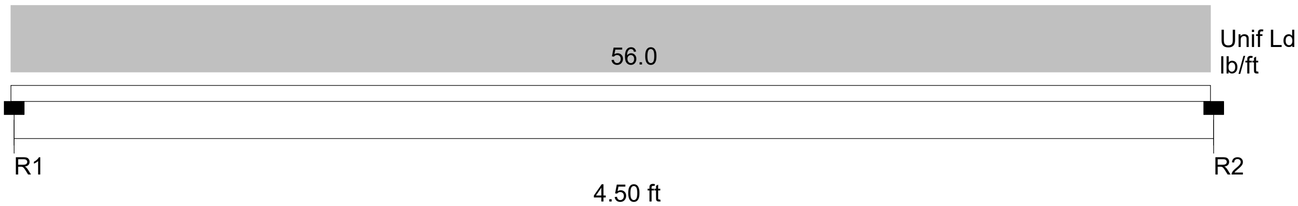
TOTAL ALLOWABLE AXIAL LOADS (lb)

WEAK AXIS BRACING	MAXIMUM KL/r	CONCENTRIC LOADING	LOADED THROUGH WEB
NONE	235	242	$\boxed{155}$
MID Pt	131	426	272
THIRD Pt	131	579	357

COMPRESSION POST
C = 126LB < 155LB OK

2012 NASPEC [AISI S100-2012]

Project: Costco **Date:** 2/16/2021
Model: Trapeze



Section : (2) 162S162-33 Back-to-Back C Stud (X-X Axis) **Fy =** 33.0 ksi
Maxo = 335.4 Ft-Lb **Moment of Inertia, I =** 0.177 in^4 **Va =** 1201.4 lb

Loads have not been modified for strength checks
Loads have not been modified for deflection calculations

Flexural and Deflection Check

Span	Mmax Ft-Lb	Mmax/ Maxo	Mpos Ft-Lb	Bracing (in)	Ma(Brc) Ft-Lb	Mpos/ Ma(Brc)	Deflection (in)	Deflection Ratio
Center Span	141.8	0.423	141.8	None	335.4	0.423	0.099	L/545

Distortional Buckling Check

Span	K-phi lb-in/in	Lm Brac (in)	Ma-d Ft-Lb	Mmax/ Ma-d
Center Span	0.00	54.0	358.4	0.396

Combined Bending and Web Crippling

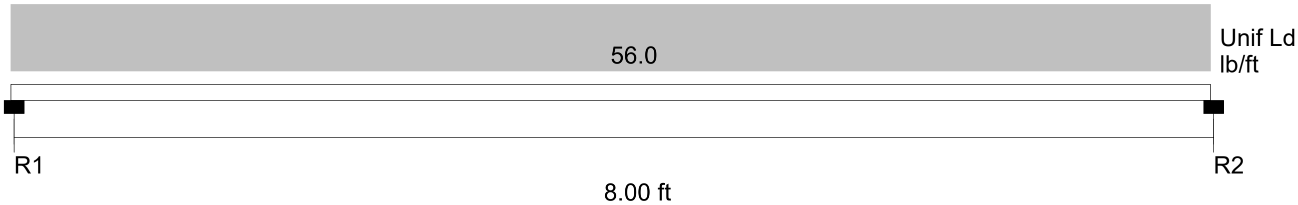
Reaction or Pt Load	Load P(lb)	Brng (in)	Pa (lb)	Pn (lb)	Mmax (Ft-Lb)	Intr. Value	Stiffen Req'd ?
R1	126.0	1.00	778.8	1557.6	0.0	0.07	No
R2	126.0	1.00	778.8	1557.6	0.0	0.07	No

Combined Bending and Shear

Reaction or Pt Load	Vmax (lb)	Mmax (Ft-Lb)	Va Factor	V/Va	M/Ma	V + M Intr.
R1	126.0	0.0	1.00	0.10	0.00	0.10
R2	126.0	0.0	1.00	0.10	0.00	0.10

2012 NASPEC [AISI S100-2012]

Project: Costco **Date:** 2/16/2021
Model: Trapeze



Section : (2) 362S162-33 Back-to-Back C Stud (X-X Axis) **Fy =** 33.0 ksi
Maxo = 881.7 Ft-Lb **Moment of Inertia, I =** 1.102 in^4 **Va =** 2047.2 lb

Loads have not been modified for strength checks
Loads have not been modified for deflection calculations

Flexural and Deflection Check

Span	Mmax Ft-Lb	Mmax/ Maxo	Mpos Ft-Lb	Bracing (in)	Ma(Brc) Ft-Lb	Mpos/ Ma(Brc)	Deflection (in)	Deflection Ratio
Center Span	448.0	0.508	448.0	None	774.9	0.578	0.159	L/605

Distortional Buckling Check

Span	K-phi lb-in/in	Lm Brac (in)	Ma-d Ft-Lb	Mmax/ Ma-d
Center Span	0.00	96.0	904.8	0.495

Combined Bending and Web Crippling

Reaction or Pt Load	Load P(lb)	Brng (in)	Pa (lb)	Pn (lb)	Mmax (Ft-Lb)	Intr. Value	Stiffen Req'd ?
R1	224.0	1.00	776.0	1552.0	0.0	0.13	No
R2	224.0	1.00	776.0	1552.0	0.0	0.13	No

Combined Bending and Shear

Reaction or Pt Load	Vmax (lb)	Mmax (Ft-Lb)	Va Factor	V/Va	M/Ma	V + M Intr.
R1	224.0	0.0	1.00	0.11	0.00	0.11
R2	224.0	0.0	1.00	0.11	0.00	0.11

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Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Feb 16, 2021 (1)	Date:	2/16/2021
Fastening point:			

Specifier's comments:

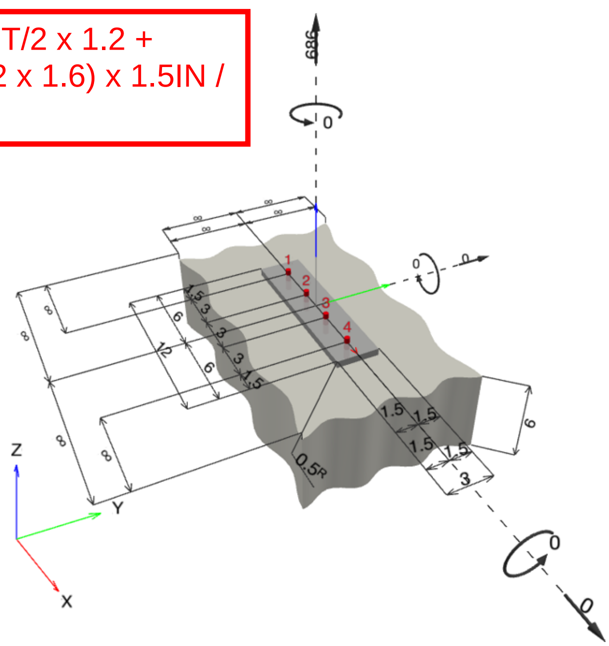
1 Input data

Anchor type and diameter:	**HDI-P TZ 3/8**
Item number:	not available
Effective embedment depth:	h_{ef} = 0.750 in., h_{nom} = 0.750 in.
Material:	ASTM A 36
Evaluation Service Report:	ESR-4236
Issued I Valid:	4/1/2020 | 7/1/2021
Proof:	Design Method ACI 318 / AC193
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate[R] :	l_x x l_y x t = 12.000 in. x 3.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	Round bars (AISC), 1/16; (L x W x T) = 0.062 in. x 0.062 in.
Base material:	cracked concrete, 4000, f_c' = 4,000 psi; h = 6.000 in.
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present
	edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	no

[R] - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]

Tu = (4PSF x 2.67FT x 8FT/2 x 1.2 + 17.1PSF x 2.67FT x 8FT/2 x 1.6) x 1.5IN / 0.75IN = 686LB



Company:		Page:	2
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Feb 16, 2021 (1)	Date:	2/16/2021
Fastening point:			

1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 686$; $V_x = 0$; $V_y = 0$; $M_x = 0$; $M_y = 0$; $M_z = 0$;	no	78

Company:		Page:	3
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - Feb 16, 2021 (1)	Date:	2/16/2021
Fastening point:			

2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Pullout Strength	171	222	78 / -	OK
Shear	-	-	-	- / -	N/A

Loading	β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
Combined tension and shear loads	-	-	-	-	N/A

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!